Dr. A. H. Clark
With the Authors
kind regards

Echinoderms

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WISSENSCHAFTLICHE ERGEBNISSE

DER SCHWEDISCHEN SÜDPOLAR-EXPEDITION

1901—1903

UNTER LEITUNG VON DR. OTTO NORDENSKJÖLD

BAND VI. LIEFERUNG 4

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Smith

Swedish South Pole Exped., 1901-03.

THE ECHINOIDEA

OF THE

SWEDISH SOUTH POLAR EXPEDITION

BY

TH.eodor MORTENSEN

WITH 19 PLATES

Smithsonian Institution
263367
JAN 29 1924
National Museum

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The Echinoidea

of the

Swedish South Polar Expedition

by

Dr. **TH. MORTENSEN**

(Copenhagen).

JAN 29 1924
263367

The collection of Echinoidea brought home by the Swedish South Polar Expedition does not contain any great number of species. It is, however, of considerable importance, affording material for study of most of the Echinoids known from the Patagonian-Chilean Region, the Echinoid-Fauna of this Region being, in fact especially interesting, from a morphological and biological as well as from a zoogeographical point of view. I have been the more pleased to undertake the working out of this collection, as I had contemporaneously undertaken the working out of the Echinoidea of the German South Polar Expedition; it was thus a quite exceptional occasion afforded to me for studying the Antarctic-subantarctic Echinoid Fauna.

At the suggestion of Professor NORDENSKJÖLD I have also studied the material of Echinoidea collected by the Swedish Expedition to the Tierra del Fuego in 1895—97, and included the results in the present work. This collection had originally been entrusted to Professor LUDWIG for study, who, however, most liberally left it to me. Though the collection proved to contain only such species as were also represented in the collection of the South Polar Expedition, it yielded valuable additional material for the study of several of the species. — Of material importance was further some material of South American Echinoidea entrusted to me for study by the Hamburg Museum.

It was thought necessary to include a few species not represented in the two Swedish collections, viz. *Abatus Philippii* LOVÉN and *Tripylus excavatus* PHIL., on account of the interrelations of these species to *Abatus cavernosus* and *Agassizii.*

The species represented in the collection of the South Polar Expedition are the following, those marked with an * being also represented in the collection of the Fuegian Expedition:

Ctenocidaris speciosa n. g. n. sp. (South Georgia, Shag Rocks Bank, Graham Region).
**Austrocidaris canaliculata* (A. AG.) (Falkland Isl.).
— *spinulosa* n. sp. » »
**Arbacia Dufresnii* (BLV.) (Coast of North Argentina).
**Notechinus magellanicus* (PHIL.) (Coast of North Argentina, Tierra del Fuego, Falkland Isl., Graham Region).
Sterechinus Neumayeri (MEISSN.) (South Georgia, Graham Region).
— *Agassizii* nom. nov. (for »*margaritaceus*«) (Falkland Isl., South Georgia, Shag Rocks Bank, Burdwood Bank).
**Loxechinus albus* (MOL.) (Tierra del Fuego).
Plexechinus Nordenskjöldi MRTSN (Shag Rocks Bank).
**Abatus cavernosus* (PHIL.), with the variety *bidens*, n. var. (South Georgia).
— *Agassizii* (PFEFFER) (South Georgia).
**Schizaster* (*Tripylaster*) *Philippii* (GRAY) (Coast of North Argentina).
Amphipneustes Lorioli KOEHLER (Graham Region).
— *Koehleri* MRTSN (South Georgia, Shag Rocks Bank).

The collection thus contains in all 14 species, 4 of which are new, viz. *Ctenocidaris speciosa*, *Austrocidaris spinulosa*, *Plexechinus Nordenskjöldi* and *Amphipneustes Koehleri;* of the two latter there has already been published a preliminary description.* The first of them also represents a new generic type. A new variety, *bidens*, had to be established for a form of *Abatus cavernosus*. The study of *Arbacia Dufresnii* revealed the fact that a quite different species has hitherto been confounded with it; this species is described here under the name of *Arbacia crassispina* n. sp.

Among the more interesting points mentioned in the present work I may name the discovery, that *Amphipneustes Koehleri* shelters its brood, quite similar to what is known in *Abatus cavernosus;* the description of the development of *Abatus cavernosus*, from the formation of the apical plates until it has reached maturity, the discovery of a distinct genital plate 5 being of special importance; further the discovery of the remarkable Phyto-Parasite, *Echinophyces mirabilis*, described from *Rhynchocidaris triplopora* MRTSN in the »Echinoiden der deutschen Südpolar-Expedition», in *Ctenocidaris speciosa*, where it produces analogous effects, the genital openings being transferred to the middle of the corresponding interambulacra.

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* TH. MORTENSEN. Some new species of Echinoidea. Vid. Medd. Naturh. Foren. Köbenhavn 1905.

I beg here to tender my best thanks to Professors HJ. THEEL, H. LUDWIG, L. DÖDERLEIN, L. JOUBIN, G. PFEFFER, Drs. O. STEINHAUS, R. HARTMEYER and the late Dr. M. MEISSNER, who have with the greatest liberality answered my requests for material, loan of type specimens or information on special points. To Mr. H. LYNGE I am indebted for the identification of some bivalve molluscs, commensalistic on some of the Echinoidea in the collection of the South Polar Expedition.

Fam. **Cidaridæ.**

Ctenocidaris n. g.

The test not very high, the vertical diameter ca. 50—60 % of the horizontal diameter, not reckoning the generally much elevated anal system. Ambulacra ca. $^1/_5$ as wide as the interambulacra; the pores very close together, the partition-wall even generally interrupted. The secondary tubercles very numerous and close, leaving no naked median space in either ambulacra or interambulacra. In larger specimens there are 8—9 interambulacral, ca. 60 ambulacral plates in each series. The apical system ca. 45 % of the horizontal diameter; all oculars excluded from the anal system. The peristome ca. 36—40 % of h. d.: interambulacral plates on the peristome reaching the mouth-edge in larger specimens. The radioles scarcely exceed the h. d. in length, rather closely set with small serially arranged thorns; otherwise covered with anastoming "hairs". The actinal radioles very coarsely serrate. Secondary spines cylindrical, clubshaped, those around the radioles more or less flattened; they are generally rather erect. The pedicellariæ are elongate, with a rather small, irregular opening, without end-tooth; only one kind known, probably representing the small globiferous form. Spicules of the usual shape.

Hitherto known only from the Antarctic Ocean.

The relations of this genus must evidently be sought for among such forms as *Rhynchocidaris* and *Notocidaris*. The pores and the secondary spines seem to point in this direction (the special character of the pores in *Rhynchocidaris triplopora* is not in disagreement herewith). The shape of the actinal radioles is peculiar in each of the three genera. The pedicellariæ, unfortunately, cannot be discussed in this connection, as the only form known from *Ctenocidaris* is probably the small globiferous; but it is the large form of globiferous pedicellariæ which is the more characteristic and thus the more important of the two forms. In any case the fact that there is no end-tooth on the pedicellariæ of *Ctenocidaris* is in accordance with the suggestion of the relationship of this genus with *Rhynchocidaris* and *Notocidaris*. — To *Austrocidaris* and *Eurocidaris* the relation is evidently not so very near; the flattened secondary spines and very little specialized actinal spines of the two latter genera are features which speak against very near relation between *Ctenocidaris* and these two genera.

Ctenocidaris speciosa n. sp.

Pl. I—II, Pl. III Figs. 1—2, Pl. IV Figs. 1—3, Pl. XIII.

Diameter.	Height. *	Width of		Number of Plates.		Apical system.	Anal system.	Peristome.	Longest Radioles.	
		Ambulacra.	Interamb.	Ambulacra.	Interamb.					
53 **	31	6	26	ca. 60	8—9	25	14	20	69	♂
51	31	5.5	25.5	61—63	8—9	23 (23.5)	13	19	54	♂
51	26	6	25	53—54	8—9	23	13	20	58	♀
46 **	28	5.5	24	ca. 60	8—9	(? broken —)		18	60	♀
43 **	22	5	22	ca. 45	7—8	19	?	15	52	♀
19 **	9	2	9	?	6—7	7.5	?	8	41	
18.5	8.5	2	9	27—28	6—7	8.5	4.2	8.5	28	
6	3	0.8	3	11—12	6	3.2	1.2	3	10	
3.5	1.8	0.5	2	6—7	4—5	2	0.6	2	4	

The shape of the test is somewhat variable, the height being sometimes only half the horizontal diameter, sometimes — and this seems to be the more general case in the grown specimens — rather more, up to 62 % of the horizontal diameter, as seen from the above measurements. In younger specimens it is generally equal to half the h. d. The sides of the test are rounded, the upper and lower sides somewhat flattened; the border of the peristome is rather strongly incurved.

The ambulacra are distinctly undulating in the upper part. Inside the primary tubercle there is, at the lower edge of the plate, another tubercle of about the same size and further one more in the inner corner of the plate, the spaces between these tubercles having quite small, miliary tubercles (carrying pedicellariæ); there is thus no naked median space left (Pl. XIII Fig. 13). The inner of the secondary tubercles is developed only at the ambitus, not in the actinal or abactinal part; in younger specimens only the outer secondary tubercle is developed, the interporiferous zone of the ambulacra thus being covered by 4 series of tubercles, as is also the case near the peristome and near the apical system in larger specimens. — The pores are rather large, very close together, separated only by a very thin wall, which is even generally interrupted in the middle, the pores thus becoming confluent (Fig. 1). The poriferous part of the ambulacral plates scarcely so broad as the non-poriferous part; it is not so distinctly sunken. — 9—10 ambulacral plates correspond to each interambulacral plate at the upper part of the test.

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* In the height is not included the elevated anal system.

** The specimens thus marked were not denuded; some of the measurements are therefore not fully reliable (e. g. the peristome) or even omitted and the number of the ambulacral plates not quite exact.

Interambulacra. The areoles are rather deep, all confluent except the three upper ones, which latter alone are round, all the lower ones being oval. The median space rather broad, closely covered by uniformly sized secondary tubercles, with numerous small miliary tubercles between them. There is thus no naked space along the scarcely depressed, median line. The beginning (at the median line) of the horizontal sutures is generally marked by a more or less distinct depression. The tubercles around the areoles are not larger than the other secondary tubercles. Also the rather narrow margin outside the areoles is closely covered by secondary tubercles.

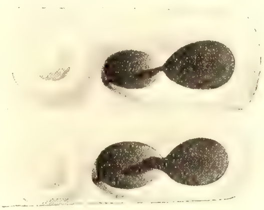
Fig. 1. Ambulacral pores of *Ctenocidaris speciosa.* $^{20}/_{1}$.

The apical system is somewhat less than half the horizontal diameter, ca. 40—47 %; in the quite young specimens it is comparatively a little larger, as seen by the measurements given above. The ocular plates are all excluded from the anal system; they are rather deeply notched in the outer edge, which is otherwise sometimes more angular, sometimes more rounded (Pl. IV Fig. 2, Pl. XIII Fig. 2). The pore is surrounded by a distinct elevation, like a ring-wall. They are covered by rather numerous small tubercles, except a more or less broad margin along the inner and outer edges, which remains bare. The genital plates are considerably broader than long, like the oculars covered by secondary tubercles leaving the margin bare. The female genital openings are very large, ca. 2 mm in diameter, close to the outer edge or even breaking through the edge of the plate (Plate XIII Fig. 2). The male genital openings are very small and remote from the edge (Pl. IV Fig. 2). The anal area is covered by an outer circle of rather large plates, inside which comes another circle of smaller plates; the middle part is covered by quite small plates, which become more or less elongate towards the anal opening. The whole anal system is, in the larger specimens, generally much elevated; the elevation begins already outside the anal system, the genital plates being more or less raised in their inner part.

The peristome is somewhat smaller than the apical system, ca. 35—42 % of the h. d., but likewise comparatively a little larger in young specimens. The ambulacral plates of the peristome are numerous, ca. 12 in larger specimens; towards the outer edge the pores may be more or less irregularly arranged. The inner plates do not join those of the neighbouring series, so that the interambulacral plates may proceed right to the mouth opening. The inner plates are densely tuberculated along their inner edge, the outer ones naked.

The radioles do not much exceed the h. d. in length, only in one case, in a young specimen of 19 mm, I find them a little more than twice as long as the h. d. They are slightly tapering towards the point, rather closely set with small thorns, which are arranged in longitudinal series, especially in the outer part, less distinctly so in the lower part (Pl. XIII Fig. 11). The ostracum is covered by a dense clothing of anastomosing hairs, which make a conspicuous meshwork round the radiole (Pl. XIII Fig. 5). The inner, reticulate portion of the spine is somewhat unusually large. Towards the actinostome the radioles, as they become shorter, become gradually more coarsely thorny in the lower part and more deeply furrowed in the outer part, the point being often a little widened and irregularly cupshaped. Two lateral series of thorns soon become much the larger, and the radioles nearest the peristome have these coarse lateral serrations alone (Pl. III Fig. 2, Pl. XIII Figs. 7, 8, 10, 12, 15). These latter radioles are also somewhat curved towards the point. — The milled ring is somewhat unusual, not distinctly limited against the lowermost part of the radiole, the furrows continuing almost to the edge of the articular cup.

The secondary spines are very numerous, rather erect. The smaller ones are quite cylindrical, more or less clubshaped; the larger ones, those around the radioles, are somewhat appressed, a little widened and flattened towards the point; they reach a length of ca. 6 mm. The spines of the apical system are short, only those surrounding the anal opening rather long. The spines of the peristome are somewhat flattened, as is usually the case in Cidarids.

The pedicellariæ are represented — in the available specimens — by one form only, which must probably be taken to be the small globiferous form, though it reaches a rather large size, ca. 0.8 mm, length of head. The valves (Pl. XIII Figs. 4, 14) are very slender and elongate, the side-edges often being somewhat concave. The opening is often somewhat irregular, the lower edge being sometimes straight across, sometimes somewhat downwards curved, or the opening may even end in a small slit below. The side-edges generally continue directly into the edges of the opening, but sometimes they are separated therefrom more or less distinctly, though never widely. The glandular cavity is narrow, very slightly elevated; generally it is smooth, but sometimes some small irregular, serrate projections occur. The stalk is without limb. The rather thick skin covering the stalk and head is richly provided with brownish chromatophores. — It may seem probable that large globiferous pedicellariæ will also prove to occur in this form, though certainly not common, since they are not found in any of the available specimens. On the other hand it is not probable that tridentate pedicellariæ will occur, in view of the fact that this form of pedicellariæ has not been found either in any of the related genera, *Notocidaris*, *Rhynchocidaris*, *Austrocidaris* and *Eurocidaris*.

The spicules of the tube-feet are of the usual shape and arranged in the usual manner, so as to leave a bare space for the tentacle nerve. The walls of the intestine contain more or less numerous, small, irregular, more or less elliptical calcareous corpuscles (Fig. 2). The organs of Stewart do not seem to contain any spicules. The genital organs contain only very few spicules, mainly of the same shape as those of the intestine.

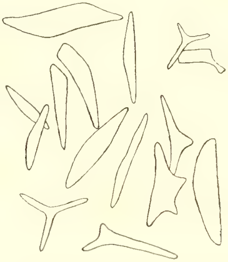
Fig. 2. Spicules from the walls of the intestine; drawn in their natural position. $^{125}/_{1}$.

As might be expected from the size of the female genital opening, the eggs are very large, ca. 1.5 mm. diameter, and rather few in number. It may be concluded with certainty that this species has not pelagic larvæ. Probably it will also prove to have some sort of care of the brood. I have, however, been unable to find the young on any of the available specimens.

The colour is dark purple, viz. the secondary spines and the test, which latter is covered by a thick skin in which the chromatophores are found. The radioles are white, with a faint tint of violet at the base, and stand out very beautifully from the dark ground-colour of the test. It is, however, rather seldom that the natural colour of the radioles is seen. Generally the radioles are covered by a profusion of foreign organisms: sponges, a Bryozoan (of the genus *Alcyonidium*), which wholly invests the radioles in a thick layer of its soft matter (Pl. I) or a small, white bivalve Mollusc (Pl. II) which proves to be viviparous; this fact accounts for the enormous numbers occurring on some specimens, the young ones taking their place on the same host as the parents. According to Mr. H. LYNGE it belongs to the genus *Limopsis*, being nearly related to, but specifically distinct from the *L. straminea* SMITH from Kerguelen.

Several specimens were taken of this beautiful and interesting species, viz.

St. 11 (65° 19′ Lat. S. 56° 48′ Long. W. 400 meter. Graham Region). 1 small specimen.
» 17 (53° 34′ Lat. S. 43° 23′ Long. W. 160 meter. Shag Rocks Bank). 10 large, 5 small specimens.
» 22 (54° 17′ Lat. S. 36° 28′ Long. W. 75 meter. South Georgia). 1 specimen (Comp. below, p. 9).
» 34 (54° 11′ Lat. S. 36° 18′ Long. W. 252—310 meter. South Georgia). 1 large, 7 small specimens.

The several small specimens enable me to give some information on the changes during growth of this species.

In a specimen of 3.5 mm. diameter the test is somewhat pentagonal. The number of coronal plates is — as given in the measurements above — 6—7 ambulacral and 4—5 interambulacral plates. On the ambulacral plates only the primary tubercle has appeared as yet; the pores are small, and the two pores of each pair stand one above the other, almost vertically, a feature characteristic of young Cidarids, as pointed out by DÖDERLEIN (Japanischen Seeigel. I. p. 30). On the peristome only two ambulacral plates are found in each series, the inner one the larger; no interambulacral plates have appeared on the peristome, but the primary interambulacral plate is already almost wholly resorbed. The areoles are all confluent, not separated by secondary tubercles, which are represented only by a single series along the inner and outer side of the areoles. — The genital plates are comparatively very large, widely separating the small ocular plates from the likewise small anal system; the latter with a double circle of small plates. Only 3 pores in the madreporite. The genital plates carry rather many tubercles, the ocular plates only one each. The radioles are strongly thorny (Pl. XIII Fig. 6); these thorns, however, are not the same as those of the fullgrown radioles, no ostracum having appeared as yet (comp. Echinoiden der deutschen Südpol.-Exp. p. 9). The secondary spines are somewhat more thorny than in the grown specimens, all clubshaped, though evidently the same ones which become flattened later on. — The pedicellariæ do not differ essentially from those of the grown specimens, only they are, of course, much smaller.

In a specimen of 6 mm. diameter the ambulacral plates number 11—12 in each series, the interambulacral plates 6. On the ambulacral plates at the ambitus the first secondary tubercle has appeared, at the lower or upper corner of the plate. The pores are less vertical. 3—4 ambulacral plates have appeared on the peristome, the inner one no longer exceeding those outside in size; no interambulacral plates have as yet appeared on the peristome. The upper areoles are separated by a row of secondary tubercles, and some few secondary tubercles have appeared outside the circle round the areoles. The apical system is not essentially different from that of the specimen of 3 mm., only some more (10) madreporic pores are found. Genital pores, of course, not yet developed. Tubercles rather numerous on all the apical plates, also the oculars. Radioles and secondary spines of the same character as in the specimen of 3 mm., only the thorns less prominent on the larger radioles.

In the next stage represented, 18.5 mm. horizontal diameter, the number of interambulacral plates is still only 6—7, the enlargement of the specimens thus being almost exclusively due to the increasing size of the plates formed at a much earlier stage. The ambulacral plates, on the contrary, have increased considerably in number, to 27—28; there is still only one secondary tubercle inside the primary one on each ambulacral plate. There are 7—8 ambulacral plates on the peristome and 2—3 interambulacral plates, which do not reach the mouth-edge. The genital openings have just appeared. Otherwise the specimen agrees with the adult specimens in all essential features, only the test is still much flatter than in the adult, as appears distinctly from the measurements given above.

One specimen from Stat. 17 and another from Stat. 22 differ in several respects rather considerably from the typical specimens, so that I have been much in doubt, whether they really belong to this species. I think, however, the conclusion to which I have finally arrived is correct, viz. that they are specimens of *Ctenocidaris speciosa* infested with the curious parasitic organism, *Echinophyces mirabilis* (comp. Echinoiden d. deutschen Südpolar-Expedition p. 12—17) and abnormally developed on account thereof, analogous to the abnormal development of *Rhynchocidaris triplopora* when infested with this parasite in its radioles. But, on account of the scarce material at hand, it can scarcely be regarded as fully beyond doubt that this conclusion is the right one.

The measurements of the two specimens are as follows:

	Diameter.	Height.	Apical syst.	Anal syst.	Peristome.	Number of ambulacral plates.	Interamb. plates.	Radioles.
St. 17	23 mm.	11	10	6—7	12	32—33	7	30 mm.
» 22	23.5 »	11	12	6—7	12	33—34	6—7	20 »

In the general structure of the test they do not differ from *Ctenocidaris speciosa;* the fact that the ambulacral plates have, with a few exceptions, only one secondary tubercle inside the primary one certainly depends on age. More noteworthy is the fact that in the specimen from St. 17 Ocular III is in broad contact with the anal plates and Ocular V nearly so; in the other specimen all the ocular plates are excluded. The peristome has, in the specimen from St. 17, only a few small interambulacral plates near the edge, in the other specimen none at all, the ambulacral plates being unusually broad and uniting with those of the neighbouring series throughout the whole length of the series, a conspicuous difference from the normal specimen of 18.5 mm. in which the interambulacral peristomial plates are already very distinct. The structure of the radioles is conspicuously different from those of the typical specimens; the ostracum is covered with the usual anastomosing »hairs», but these end in numerous very fine points, not in single, comparatively coarse thorns as in the normal specimens (Pl. XIII Fig. 5 comp. with the Fig. 3 here given). Further the actinal radioles have not the coarse dentations as in the typical specimens.

Also the pedicellariæ afford some differences. In the specimen from St. 17 they are invested by an unusually thick skin, but otherwise the structure of the valves is the same as in the normal specimens; in the specimen from St. 22, on the other hand, the valves differ rather considerably from those of the normal specimens, the opening being broadly triangular with the lower edge almost or wholly straight (Pl. XIII Fig. 9).

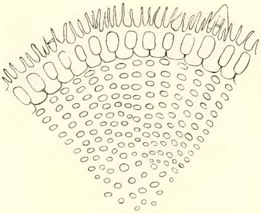

Fig. 3. Transverse section of radiole from a specimen of *Ctenocidaris speciosa* infested with *Echinophyces*. $^{50}/_{1}$.

On a closer examination I find that these specimens show in their radioles a structure quite similar to that which I have described for *Rhynchocidaris triplopora* (Op. cit.). The curious tubes protruding through the thorns of the radioles are also found here, though not so strongly developed as in that species. In one case I have further found in a section of a radiole an organism* boring in the chalk matter, quite similar to that which I have described from that species — in short, I think it can scarcely be doubted that these specimens are infested with *Echinophyces*, though I have, unfortunately, not found anything corresponding to the "spores" found in *Rhynchocidaris*.

The differences from the normal specimens occurring in these two specimens I must then suppose to be due to the reaction against the parasite. It is further worth noticing that genital pores have apparently not yet been developed in these specimens, though they have appeared in the normal specimen of 18.5 mm. But on the other hand these specimens show the curious feature of having a small opening in the median interambulacral line at the ambitus (Pl. XIII Fig. 1). In view of the fact that in *Rhynchocidaris* the genital openings have become transferred to the edge of the peristome in specimens infested with *Echinophyces*, it seemed not unreasonable to suggest that these curious openings in the middle of the interambulacra are the abnormally placed genital openings. In order to state this definitely I have opened one of the two specimens and found that this small interambulacral opening is really the genital opening. As was the case in *Rhynchocidaris*, the normal, genital duct exists but is, evidently, out of function. From the genital gland a new efferent duct is developed, going in the opposite direction, ending in the pore situated in the middle of the interambulacrum. As this new duct is rather short, it can only be seen on cutting most of the genital gland away; in the figure (Pl. XIII Fig. 3) only the upper part on the left side of the gland has been left. The specimen opened is a male.

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* In the same radiole I find here and there in the meshes made by the »hairs» on the ostracum a worm-like organism, irregularly rolled up — the same I found in the radioles of *Rhynchocidaris*. It looks very much like a Nematod. As I did not feel myself able to put beyond doubt whether it really is a Nematod or something else, I sent a preparation of it to my friend, the eminent specialist in Nematods, Dr. L. JÄGERSKJÖLD in Gothenburg, asking him to examine it. He kindly informed me that he thought it most likely a Nematod-Larva; but the material did not allow him to state anything more definitely about the animal. — There can thus scarcely be any doubt that the worm has nothing to do with the abnormal changes in these specimens; it only takes a place on the infested spines.

Austrocidaris canaliculata (A. AG.).

Pl. III Figs. 6—8, Pl. IV Figs. 4—11, Pl. XIV Figs. 1—2, 6—11, 16—18.

Temnocidaris	*canaliculata.*	A. AGASSIZ. 1863. List of Echinoderms etc. Bull. Mus. Comp. Zool. I. p. 18.
Goniocidaris	—	A. AGASSIZ. 1872. Revision of Echini p. 131, 395. Pl. I. c. Figs. 6—8, I. g. Fig. 2.*
—	—	WYV. THOMSON. 1876. Notice of some peculiarities in the mode of propagation of certain Echinoderms of the Southern Sea. Journ. Linn. Soc. Zoology. XIII. p. 65. Fig. 5.
—	—	WYV. THOMSON. 1877. The Atlantic. II. p. 223. Fig. 41.
—	*vivipara.*	TH. STUDER. 1876. Über die Echinodermen a. d. antarktischen Meere etc. Monatsber. d. Berliner Akad. p. 455.
—	*canaliculata.*	TH. STUDER. 1880. Übersicht über die während d. Reise d. »Gazelle» ges. Echinoiden. Monatsber. d. Berliner Acad. p. 867.
—	—	TH. STUDER. 1880. Über Geschlechtsdimorphismus bei Echinodermen. Zool. Anzeiger N:o 67. p. 6. Fig. 8—9.
—	—	A. AGASSIZ. 1881. »Challenger» Echinoidea p. 43—46 (pro parte). Pl. II. Figs. 2, 4, 6, 7. The other figures of the Pl. II, as also the figures 1—3 of Pl. XLIV are partly uncertain, partly not belonging to this species (e. g. II. 1 and 5).
Cidaris (*Dorocidaris*)	*canaliculata.*	L. DÖDERLEIN. 1887. Die Japanischen Seeigel. I. Cidaridæ. p. 16—18, 50. Taf. IX. Fig. 6. a—p.
Goniocidaris	*canaliculata.*	G. PFEFFER. 1890. Niedere Thierwelt d. antarkt. Ufergebietes. p. 110.
—	—	S. LOVÉN. 1892. Echinologica. Bih. Sv. Vetensk. Akad. Handl. 18. Afd. IV. N:o 1. p. 5. Pl. I—III.
—	—	F. BERNARD. 1895. Echinides recueillis par l'expédition du Cap Horn. Bull. Mus. d'hist. nat. N:o 7. p. 1.
—	—	E. M. PRATT. 1898. Contrib. to our knowledge of the marine Fauna of the Falkland Islands. Mem. Manchester lit. & philos. Soc. 42. No. 13. p. 17.
Dorocidaris	—	H. LUDWIG. 1899. Echinodermen des Sanzibargebietes. Abh. d. Senckenb. naturf. Gesellsch. XXI. p. 550.
Cidaris	—	M. MEISSNER. 1900. Echinoiden d. Hamburger Magalh. Sammelreise. p. 3.
Goniocidaris	—	E. HESSE. 1900. Die Mikrostructur d. fossilen Echinoideenstacheln N. Jahrb. f. Mineral., Geol., u. Palæontol. XIII. Beil. Bd. p. 208. Taf. XII. Fig. 1. A. B.
Stereocidaris	—	TH. MORTENSEN. 1903. Ingolf-Echinoidea. I. p. 25—27. Pl. VIII. Figs. 6, 8, 32. II (1907) p. 15.
Centrocidaris	—	A. AGASSIZ. 1904. Panamic Deep Sea Echini. Mem. Mus. Comp. Zool. XXXI. p. 3—4, 32.**

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* Pl. XXIV, Fig. 10 cited by AGASSIZ as belonging to this species is stated in the explanation of the plate to belong to *Phyllacanthus dubia;* it represents a valve of a tridentate pedicellaria, and since tridentate pedicellariæ are not found in *A. canaliculata*, it is probably the explanation which gives the correct statement.

** In a note AGASSIZ here states to have originally placed it in the genus *Temnechinus.* This is, of course, only a lapsus calami for *Temnocidaris.*

Stereocidaris	*canaliculata.*	L. DÖDERLEIN. 1906. Echinoiden d. deutschen Tiefsee-Expedition p. 96, 102.
—	—	R. KOEHLER. 1907. Astéries, Ophiures et Échinides recueillis dans les mers australes par la »Scotia» (1902—1904). Zool. Anzeiger. XXXII. p. 143.
Austrocidaris	—	H. LYM. CLARK. 1907. The Cidaridæ. Bull. Mus. Comp. Zool. LI. p. 212.
(?) *Cidaris*	—	F. JEFFR. BELL. 1908. Echinoderma. National Antarctic Expedition. Natural History. Vol. IV. Zoology. p. 5.
Stereocidaris	—	R. KOEHLER. 1908. Astéries, Ophiures et Échinides de l'Expédition antarctique nationale Écossaise. Trans. R. Soc. Edinburgh. Vol. XLVI. p. 615.
Austrocidaris	—	TH. MORTENSEN. 1909. Echinoiden d. deutschen Südpolar-Expedition p. 37—39.

Non: *Cidaris nutrix* WYV. THOMS.
Goniocidaris membranipora STUDER.
Stereocidaris Lorioli MRTSN.

The rather intricate synonymic history of this species has probably at length come to an end; after having been referred in the course of time to no less than 6 different genera it has now been made the type of a new genus, *Austrocidaris*, and there it will doubtless remain. To be sure the author of the genus, Professor H. LYM. CLARK, thinks it only slightly different from *Dorocidaris* — »were it not for their geographical isolation it would hardly be worth while to separate these three small species from Dorocidaris», he says (Op. cit. p. 212). This conclusion, however, can only be arrived at, when the characters afforded by the pedicellariæ are left out of consideration. When these characters are taken into account — and I hope to have proved in my »Echinoiden d. deutschen Südpolar-Expedition», that the reasons produced by CLARK against using the pedicellariæ in the classification of Cidaridæ are irrelevant — it is evident that *Austrocidaris* is not so very nearly related to *Cidaris* (*Dorocidaris*); the pedicellariæ, on the contrary, decidedly point towards *Stereocidaris* as the nearest relation. With *Goniocidaris*, to which genus most authors have referred it, following AGASSIZ, it is not very closely related, as DÖDERLEIN (Jap. Seeigeln p. 18) has sufficiently demonstrated. The deep median vertical furrow * — the character which has caused its reference to this genus — is certainly very different (»durchaus nicht gleichwertig» DÖDERLEIN) from the depressions of the horizontal sutures so characteristic of *Goniocidaris* (though in large specimens of *Goniocidaris* the vertical sutures are also deepened); also the pedicellariæ are different — especially the long end-tooth of the small globiferous pedicellariæ in *Goniocidaris* is a characteristic difference from *Austrocidaris.* — The nearest relation of *Austrocidaris* probably is the genus *Eurocidaris*, established for the Kerguelen-species *nutrix*, so long erroneously confounded with *canaliculata.* * The characters distinguishing these two genera have been pointed out in my »Echinoiden d. deutschen Südpolar-Expedition» (loc. cit.), to which I may refer.

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* The alleged great variability of this furrow in *canaliculata:* it being sometimes very distinct, sometimes even totally absent, is due to the confusion of *canaliculata* with other species, especially *Eurocidaris nutrix.* In true *canaliculata* it scarcely ever disappears. It is true, DÖDERLEIN states (Japanischen Seeigel p. 17) that in one of his specimens of *canaliculata* »findet sich keine Spur einer solchen Furche, das Miliarfeld ist hier ganz flach und die Mittelnaht kaum zu erkennen». He further states that all his specimens proceed from Patagonia and the Magellan Strait, so that there should be no possibility of this specimen without the deep median line being *E. nutrix.* On my applying to Professor DÖDERLEIN concerning this matter, he most kindly sent me the specimen for examination, adding the information that it was bought from a dealer in Naturalia in Basel, who had got it from Prof. STUDER with other specimens of natural history from the »Gazelle». It was labelled »Gon. canaliculata, Ost-Patagonien». — The examination of this specimen shows beyond doubt — in spite of the absence of the characteristic large globiferous pedicellariæ — that it is *Eurocidaris nutrix;* especially the apical system, so different from that of *A. canaliculata*, leaves no doubt of the identification. There must then evidently have been some confusion of the labels by the dealer — or by STUDER. Of course, this specimen could not be taken as a proof of the occurrence of *E. nutrix* at Patagonia, against all other evidence.

Though both AGASSIZ and DÖDERLEIN have given descriptions of this species, the maintaining of *E. nutrix* as a distinct species — even of another genus — and the establishing of the new species of *Austrocidaris* described below make a renewed detailed description of *canaliculata* highly desirable.

	Diameter.	Height.	Apical system.	Anal system.	Peristome.	Width of		Plates of		Longest Radioles.	Remarks.
						Ambulacra.	Interambul.	Ambulacra.	Interambul.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.	
♀	26	15	10.5	7	10.8	3	12.5	38—39	8	19	
♂	21	10.5	8.5	5.5	9	2.8	9.5	30—31	7—8	—	
♂	20 (19.5)	10	8.8	5	9	2.6	9.5	29	7	—	A little oblong.
♀	17.8	9	7.8	5	8.8	2	8	27—28	7	—	
♂	14.5	7	6	3.8	7.5	2	6.8	23—24	6—7	11	
	9.5	5	4.5	2.8	5	1.3	4.8	17—18	6	8.5	No genital openings.
	8.2	4	4	2.2	4.2	1	4	14—15	6	7.5	
	7	3.5	3.2	2	3.8	1	3.2	12—13	6	6.8	
	5	2.5	2.8	1.3	2.8	0.9	2.1	9—10	5—6	4	
	21	—	—	—	—	—	—	—	—	14	
	18	—	—	—	—	—	—	—	—	12	
	17	—	—	—	—	—	—	—	—	20	
	16	—	—	—	—	—	—	—	—	11	
	15	—	—	—	—	—	—	—	—	12.5	
	14.5	—	—	—	—	—	—	—	—	14.5	

The test (Pl. IV Figs. 4—6, 8—11) is rather low, the height generally not exceeding half the horizontal diameter. The abactinal side is flat, or even — especially in the females — considerably sunken. The actinal side is flat, the edge of the peristome not incurved; the sides of the test beautifully rounded.

The ambulacra (Pl. XIV Fig. 1) are about one fourth as wide as the interambulacra; the poriferous zone is a little narrower than the non-poriferous part of the plates. The primary ambulacral tubercles are rather conspicuous; inside these there is at the lower edge of each plate a much smaller tubercle, the whole area thus carrying four vertical series of tubercles. According to AGASSIZ (Revision of Echini p. 396) there are, besides the primary series, »two irregular vertical rows on each side of the median furrow, with a few miliaries scattered irregularly between the secondary tubercles towards the poriferous zone». Even in the largest specimens examined by me (26 mm. in diameter) I find only one secondary tubercle on each plate; the second of these small tubercles is thus evidently found only in still larger specimens (comp. below, the specimens from Altata?). — The median furrow is narrow, but mostly quite distinct. The pores are described in the »Revision» as »adjoining; ridge separating pairs of pores prominent». This is quite correct, and it need only be added that there is a distinct depression all round each pair (Fig. 4). (The difference in the shape of the pores between this species and *E. nutrix* has been emphasized in the Report on the Echinoidea of the German Southpolar-Expedition; Fig. 4 to compare with Taf. X Fig. 7 of the latter work.) — In the larger specimens there are 5—6 ambulacral plates to each interambulacral plate, at the ambitus.

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* It is worth remarking that WYV. THOMSON, the author of *nutrix*, regards it as generically different from *canaliculata*, referring the former to the genus *Cidaris*, the latter to *Goniocidaris;* this course is also held by STUDER in his »Übersicht d. Gazelle-Echinoiden». (Comp. also MEISSNER, Op. cit. p. 4.)

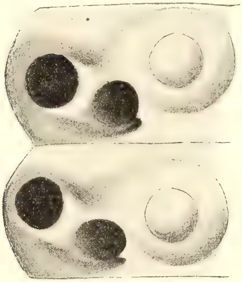
Fig. 4. Ambulacral pores of *Austrocidaris canaliculata.* $^{42}/_{1}$.

The interambulacra are especially remarkable by the broad, deep, sharply cut, median furrow, which I find to be distinct in all the specimens before me (Pl. IV Fig. 4). (Regarding the quite young specimens comp. below.) The areoles are rather deep, only those nearest the peristome confluent. The circle of tubercles surrounding the areoles rather prominent; outside this circle a few smaller tubercles occur at the outer edge of the plates and some more adjoining the median furrow. These tubercles are considerably smaller than those of the edge of the areoles.

The apical system (Pl. IV Figs. 5—6, 9—10; Pl. XIV Fig. 6) is comparatively small, ca. 41—44 % of the horizontal diameter of the test. The ocular plates are in larger specimens generally all in broad contact with the anal system. DÖDERLEINS statement (loc. cit.) that he finds »bei einem ziemlich grossen Exemplar . . . das Analfeld vollständig eingeschlossen von den Genitalplatten», evidently refers to the specimen of *E. nutrix* and thus has no bearing on any variability in this character in *canaliculata*. Further, when AGASSIZ says in »Revision of Echini» p. 396: »Genital plates in contact», which cannot mean anything but that the oculars are excluded from the anal area, I would suggest that »genital» is a lapsus calami for »ocular». — The ocular plates are distinctly broader than high, lozenge-shaped, a somewhat uncommon form; the inner angle is generally cut off to some extent, the more so the older the specimen; the ocular pore is situated in the outer angle, not near the centre of the plates, as stated in »Revis. of Ech.». A group of small tubercles are found in the middle of the plates; no elevation round the pore. (The very conspicuous difference in the shape of the ocular plates in *A. canaliculata* and *E. nutrix* is well seen on comparing Pl. IV Figs. 6, 9—10, Pl. XIV Fig. 6 with Taf. VI Figs. 4, 7—8 in Echinoiden d. deutschen Südpolar-Expedition.)

The genital plates are somewhat irregular in shape, considerably (about twice) broader than long; the outer edge generally forms a rather prominent point, in which the genital pore is situated. In the male the genital pores are quite small, scarcely larger than the ocular pores; in the female they are large,* occupying the whole point of the plate, and even halfway outside the plate (Pl. IV Figs. 9—10). In the skin covering the sides of the opening some small, irregular plates may be developed. The madreporite is scarcely larger than the other genital plates. Each plate carries a group of tubercles in the middle, leaving a comparatively broad bare edge, especially along the inner side. One specimen shows a curious anomaly, the genital plate 1 being divided into three triangular plates, two of which are provided with a genital opening (Pl. IV Fig. 5). — The anal plates are fairly numerous, small, the outer ones generally not much larger than the inner ones; they are rather thick, each carrying one or a few tubercles, according to their size. — In the younger specimens the anal system is somewhat elevated, in the larger ones the whole apical system is more or less sunken, in accordance with the fact that the species carries its brood upon the abactinal area. (It is, however, to be noticed that also the males, who do not carry the brood, have the apical system sunken.)

The peristome (Pl. IV Fig. 11) is generally somewhat larger than the apical system. The ambulacral plates on the peristome are numerous and close-set; in the larger specimens I find 9—11 plates in each series; each plate carries two tubercles inside and one or two outside the pore. The innermost pore remains distinctly larger than the following ones. The inner plates of each two adjoining series do not join, so that the interambulacral plates proceed right to the edge of the mouth; these interambulacral plates are small and irregular, each carrying one or two tubercles, according to size.

The radioles are in all the available specimens short, generally shorter than the horizontal diameter of the test, sometimes, however, surpassing it a little in length; that they may, however, be considerably longer, up to about twice the diameter of the test, is stated by AGASSIZ, DÖDERLEIN and CLARK. Even if there has probably been some confusion with other species (thus e. g. it seems very hard to recognize the specimen figured in the »Challenger»-Echinoidea Pl. II Fig. 1 as a true *A. canaliculata*) it can evidently not be doubted that the length of the radioles may really vary to a considerable extent. As correctly described in the »Revis. of Echini» they are comparatively slender, slightly tapering, somewhat swelling at the base; they are closely set with small thorns, longitudinally arranged, uniting into longitudinal ridges towards the point (Pl. XIV Fig. 18). Between the thorns the ostracum is covered by rather coarse, bushshaped, somewhat anastomosing »hairs» (Fig. 5) — a conspicuous difference from *E. nutrix* (comp. Taf. XIII Fig. 7, Echinoidea d. deutschen Südpolar-Exped.). — The actinal radioles (Pl. XIV Figs. 7—8, 11) are very little specialized, only gradually shorter and with the thorns more or less reduced, sometimes quite smooth; they are not distinctly flattened or curved.

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* WYV. THOMSON, Op. cit. p. 65. says »the ovarial openings are extremely minute»; evidently he has only examined a male in this respect, otherwise he could not have said so.

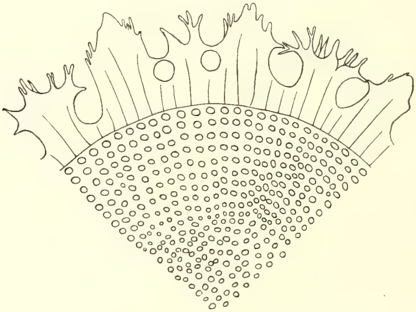

Fig. 5. Transverse section of radiole of *Austrocidaris canaliculata.* $^{65}/_{1}$.

The secondary spines are generally appressed; those round the radioles are the longest, ca. 3 mm., the primary ambulacral spines are a little shorter; the miliary spines are scarcely half the length of the primary ones. The spines on the apical system are very short, only those surrounding the anal opening are somewhat longer. The smaller spines are cylindrical, the larger ones, especially those round the radioles, are distinctly flattened and rather broad, not pointed. They are very smooth.

The pedicellariæ are rather inconspicuous and not very numerous. The large globiferous pedicellariæ are typically of the form shown in Pl. VIII Fig. 32 of the »Ingolf»-Echinoidea I; but they may vary not inconsiderably. The side-edges do not always proceed as far as the terminal opening, but may end at a shorter or longer distance below; but they may also pass almost to the very point of the valve, the opening thus lying within the blade, and in this case the opening may be somewhat smaller than usual. On the other hand it must be noticed that a form recalling that of the large globiferous pedicellariæ of *Austrocidaris Lorioli*, figured in the »Ingolf»-Ech. I. p. 170 Fig. 7, was never met with in any of the specimens examined by me. — The small globiferous pedicellariæ occur in two main forms: one short (Ingolf Ech. I. Pl. VIII Fig. 6), the other elongate, narrow (Pl. XIV Figs. 16—17), somewhat recalling tridentate pedicellariæ; probably it is this form which has been figured by DÖDERLEIN in his »Japanischen Seeigel» Taf. IX Fig. 6 e and m, and probably also the figure k represents such an elongate globiferous pedicellaria, since tridentate pedicellariæ have otherwise not been met with in *canaliculata*, either by CLARK or by myself. The two forms of the small globiferous pedicellariæ are connected by all transitions, and upon the whole they vary considerably. — In the young ones only small globiferous pedicellariæ are found; they are, from their first appearance in the embryos, mainly of the same shape as in the grown specimens.

The spicules of the tube-feet are of the usual form and, as usual, arranged so as to leave a bare space for the tentacle-nerve. The lower tube-feet have a comparatively large sucking disc, with four rosette plates; in the abactinal tube-feet the sucking disc is not developed, and the spicules are few and small; in the tube-feet on the peristome the disc is small and irregular, and the spicules near the disc generally developed into larger, irregular plates. — The walls of the intestine, the genital organs and the organs of Stewart contain no spicules. The latter organs are small and inconspicuous; the genital organs are also small, with only comparatively few, but rather large eggs. (The size of the eggs cannot be given, since the examined specimens contained only unripe eggs.)

The large primary tentacles of the embryos contain no spicules, only a small ring in the point.

The auricles (Pl. XIV Fig. 2) are divergent, otherwise not peculiar. Ambulacral prominences distinct.

The colour is recorded by AGASSIZ (Rev. of Ech.) to be of a brilliant orange. The specimens preserved in alcohol show only a reddish tint at the base of the radioles, otherwise they are straw-coloured.

The viviparous habit of the species (carrying its eggs and young on the apical area, contrary to *E. nutrix* which carries them on the peristome) is well known and need not be further mentioned. None of the specimens in hand carry young ones.

The species was taken by the Swedish South Polar Expedition at the following localities:

St. 43. Falkland Islands (51° 33′ Lat. S. 58° 9′ Long. W. Port Louis). Low water; stony bottom with algæ. Several small specimens.

» 52. — — (51° 40′ Lat. S. 57° 44′ Long. W. 17 m. Port William). 2 small specimens.

» 53. — — (51° 40′ Lat. S. 57° 44′ Long. W. 12 m. Port William. Sand and gravel). 2 specimens.

St. 54. Falkland Islands (51° 40′ Lat. S. 57° 50′ Long. W. 10 m. Stanley Harbour. Mud with shells). 2 specimens.
» 55. — — (55° 11′ Lat. S. 60° 26′ Long. W. 40 m. Port Albemarle. Sand bottom with algæ). Several small specimens.

Further there are specimens from the »Fuegian»-Expedition, from Port Lanis, 3 specimens, and from Cape Valentyn, 150 fms., bottom with dead shells, 1 specimen.

A. canaliculata is as yet known with certainty only from the South American East Coast, from its Southern extremity to about 44° Lat. S., and from the Falkland Islands and the Burdwood Bank; its bathymetrical distribution is not known with certainty to be more than 0—150 fms. Evidently it is mainly a littoral form, occurring even at the low water mark. It is worth noticing that it is not recorded from the West Coast of South America.

According to the literature the species has a much greater horizontal and bathymetrical distribution; but none of these statements as to the occurrence of *canaliculata* in other parts of the world rest on sufficient evidence, either the localities or the identifications being unreliable.

The species was originally described under the name of *Temnocidaris canaliculata* (List of Echini etc. Bull. Mus. Comp. Zool. I. 1863. p. 18) with the only locality »Caroline Islands». In the »Revision of Echini» this locality is not mentioned, but Rose Island (Samoa Islands, according to ANDRÉE's Atlas), Orange Harbour (? — not in ANDRÉE), Zanzibar and Natal, besides the South American localities. In the »Challenger» Echinoidea (p. 209) are further given the localities: Marion Island, Kerguelen, Heard Island, Australia and Antarctic, and the bathymetrical distribution is given as — 1975 fathoms. All these statements are summed up thus by E. PRATT (Op. cit. p. 17): »This species has an extensive distribution. Southern Oceans, 1600—1975 fath. Sandwich and Navigator Islands. Natal. Falklands, 5—12 fath. It ranges along the southern extremities of all the southern continents and extends north of the equator to Japan. *G. canaliculata* has a wider distribution than any other species of this genus, which is restricted, with this exception to the Southern hemisphere and to the tropics. An interesting fact concerning this species is that it extends through the tropics to the northern hemisphere along the western shores of the Pacific and not along the *eastern* shores, as one would expect. This is still more interesting when we note that this species occurs at the southern extremities of America and Africa.» A finer illustration of what may result from uncritical compilation of statements found in the literature * could scarcely be wished.

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* I have been unable to find in the literature any statement of the occurrence of this species at Japan; is it, perhaps, the fact that the species is mentioned in DÖDERLEIN's »Japanische Seeigel» (though under the heading »Recente Cidariden von nicht japanischer Herkunft») which has caused Miss PRATT to state that it occurs also at Japan? In any case the species certainly does not occur there.

I have not been able myself to examine the specimens from all these different localities. Only from the Kerguelen region I have examined a good number of specimens and found them to be either *Eurocidaris nutrix* or other species (probably of the genus *Aporocidaris*, viz. those from the greater depths, 1600—1975 fms., »Challenger» Stations 147, 153, 156). In LUDWIG's »Echinodermen des Sansibargebietes» (Abh. d. Senckenb. naturf. Ges. XXI. 1899) the only statement concerning this species is: »Soll nach einem von A. AGASSIZ (1872) angeführten Exemplare des Leipziger Museums auch bei Sansibar vorkommen. Von anderer Seite hat dieser Fundort aber noch keine Bestätigung erhalten» (p. 551). The locality »Navigator Islands», according to CLARK (»The Cidaridæ» p. 213), rests on a specimen in the U. S. National Museum, »which was obviously collected many years ago». Upon the whole it may be said that all these statements of the occurrence of the species *A. canaliculata* in the Indo-Pacific Region, from the Cape to Japan, rest on incorrect determinations or, if the identifications be correct, the localities are untrustworthy. Accordingly these old statements should be left out of consideration until new and trustworthy evidence has been procured. *

Quite recently the species has been recorded from the Antarctic continent and from Tasmania by Prof. F. JEFFR. BELL in his paper on the Echinoderma of the National Antarctic Expedition (National History. Vol. IV. Zoology p. 5). Since, however, Professor BELL still regards *E. nutrix* as identical with *canaliculata* and, upon the whole, emphatically holds to the old standpoint, disregarding the characters afforded by the minor, microscopical structures (pedicellariæ etc.), these statements do not afford the incontestable evidence needed, before these localities of the species can be finally accepted. It is quite possible that the specimens from the Antarctic are really *canaliculata;* that those from Tasmania should prove to be so I think most improbable.

In the paper quoted Prof. BELL says about *A. canaliculata:* »It seems to have escaped notice that this *consensu omnium* (with the exception of Dr. MORTENSEN) circumpolar Antarctic form was first described from the »Caroline Islands», which Caroline Islands we surmise to be those in the Pacific . . . . . . that is to say, the species was founded on specimens said to be found within the tropics.» He therefore doubts whether the original *canaliculata* is identical with the species now understood by that name. If the original locality was correct, the doubt is certainly justified.

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* After the above had been printed I received a paper »Echinoidea from the Kerimba Archipelago, Portuguese East Africa (Mozambique)» by Dr. R. N. RUDMOSE BROWN (Proc. R. Rhys. Soc. Edinburgh. Vol. XVIII. 1910), in which »*Goniocidaris*» *canaliculata* is recorded from several localities on this coast. On my applying to the author concerning this statement, which I could hardly believe to be correct, the more so as a few remarks on the spines of these specimens given by the author did not suit well to *Austrocidaris canaliculata*, he most kindly sent me a pair of the specimens. They are *Eucidaris metularia* (LAMK.) and thus have nothing with *Austrocidaris canaliculata* to do.

But most probably the locality was incorrect; until it is proved that the type specimen — if it exists any more — is really different from the Patagonian specimens, there is no reason to deprive this species of the name *canaliculata*.

It naturally followed from the confusion of *Eurocidaris nutrix* a. o. species with *canaliculata*, that the latter was stated to be exceedingly variable. Judging from the by no means small material at my disposal I must maintain that it is not exceptionally variable. The length of the radioles, it is true, may vary considerably, but otherwise I find the characters fairly constant; especially I have always found the peculiar deep median ambulacral and interambulacral furrows distinct, though the ambulacral one may be rather narrow. Also the pedicellariæ I find rather constant (comp. above p. 16—17).

In the »Ingolf» Echinoidea I. (p. 170) I gave a preliminary description of a new species, *Stereocidaris Lorioli*, from the »Challenger» St. 320; in the »Challenger» Echinoidea it was referred to *Dorocidaris papillata*. (In the »Panamic Deep Sea Echini» (p. 228) this error is still maintained, *D. papillata* being still noted as occurring at La Plata and the Philippines.) CLARK (»The Cidaridæ» p. 212), though joining me in distinguishing this form from *papillata*, maintains that *Stereoc. Lorioli* is only a synonym of *Austrocidaris canaliculata*, stating that he has all transitional forms. — That the species does not belong to the genus *Stereocidaris* s. str. I can easily agree (though I should like to examine all the characters of *Lorioli* before stating so definitely); but that it should be only a synonym of *canaliculata* I must doubt. I have never found in *canaliculata* globiferous pedicellariæ recalling in the shape of their valves those found in the type of *Lorioli* (»Ingolf»-Ech. loc. cit. Fig. 7). On the other hand, Prof. CLARK, who disregards the differences found in the pedicellariæ of the Cidarids, may perhaps on that account have been led to overlook minor structural differences, which may possibly be found. In any case I cannot feel convinced that the species shortly described by me under the name *Lorioli* is synonymous with *canaliculata*, until a renewed and fuller examination of the type specimen has shown that it cannot really be distinguished from that species.

In the Zoological Museum of Copenhagen are preserved two specimens, labelled »Altata Salmin. 1870», which belong in any case to the genus *Austrocidaris;* probably they are even *A. canaliculata*, though some minor differences may be pointed out. In case the locality is correct, they will perhaps prove to be a distinct species; but I think it rather more possible that the locality is wrong, seeing that *A. canaliculata* has otherwise not been recorded from that region. * In any case these specimens are of considerable interest, especially the larger one, so that I feel justified in giving a short description of them, noticing the points of difference from *canaliculata*. The measurements are as follows:

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* In his paper »Fortsatte kritiske og beskrivende Bidrag til Kundskab om Söstjernerne (Asteriderne)». Tredie Række. (Vid. Medd. Naturh. Foren. Köbenhavn 1871 p. 289) LÜTKEN mentions these specimens and several other Echinoderms as being maintained by SALMIN to have come from Altata. On account of several of these Echinoderms being Patagonian forms LÜTKEN doubts the correctness of the locality for

	Diameter.	Height.	Apical system.	Anal system.	Peristome.	Width of		Number of plates.		Radioles.
						Ambulacra.	Interambulacra.	Ambulacra.	Interambulacra.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.
♀ . . .	42	22	15.5	11	16	4.5	20	42—43	7—8	27
♂ . . .	20	11	8.5	5.5	9	2.4	10	30—31	7—8	26.5

The younger specimen differs from an equally sized specimen from South America in the genital plates having a less prominent outer angle (Pl. XIV Fig. 6). On the peristome the interambulacral spaces are somewhat narrower within, the interambulacral plates thus scarcely reaching to the mouth-opening. Otherwise I do not see any differences from the typical form.

The larger specimen differs considerably more from the typical form. The apical system is especially interesting (Pl. XIV Fig. 10). The genital and ocular plates have been greatly reduced, the former even partly split up into small irregular plates, so that it can scarcely be said with certainty which of them represent the genital plates; only the madreporite has almost kept its original size. In accordance with this reduction of the genital plates the anal system has greatly increased in size; on account of the small size of the numerous anal plates it is somewhat movable, much as in an *Echinus*. The whole apical system to some degree recalls that of the Echinothurids (especially on account of the great reduction of the genital plates). One is also reminded of the apical system of »*Stephanocidaris*», the »echinoid» character of whose anal system is so persistently emphasized by AGASSIZ and CLARK.

The small upper interambulacral plates are closely covered with secondary tubercles round the rather small areoles, whereas otherwise the upper plates are generally more or less naked. This means, evidently, that this specimen has reached its full size, and these upper plates are not increasing in size any more; likewise no small, just beginning, plates are found at the outer sides of the genital plates, as are elsewhere generally found. — The Fig. 7 Pl. II of the »Challenger» Echinoidea probably represents a similar stage. — The upper radioles are also fully formed, though considerably smaller than those at the ambitus. (Unfortunately I did not observe the quite uppermost ones before denuding the apical part; evidently they have not been longer than the secondary spines.)

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hese species — the more so, as the captain who brought the collection from Altata to SALMIN had also dredged on the coast of Patagonia in depths of 40—50 fathoms. After this I do not doubt that these wo specimens are really from South America, not from Altata.

The ambulacra and interambulacra show a somewhat larger number of secondary tubercles than is the case in the smaller specimens of the typical form; each ambulacral plate has two small tubercles inside the primary one. Otherwise no difference is found herein. The median furrow is distinct, of the usual width. The peristome has 10—11 ambulacral plates in each series; the 2—3 inner ones almost join those of the adjacent series, the interambulacral plates thus scarcely reaching the mouth-edge.

The pedicellariæ are like those of the typical form, only in the large specimen I find another peculiar form of small globiferous pedicellariæ (Pl. XIV Fig. 9) which I have not found in other specimens. — The radioles, the secondary spines and the spicules are as in the typical form. — The apical system and the adjoining part of the test is somewhat sunken in the larger specimen; young ones, however, were not found on it.

Whether now these specimens are *A. canaliculata* or another nearly related species, and whether the locality Altata is correct or not, they are in any case of considerable interest (especially the larger specimen) through the curious reduction of the apical plates, which reminds one of the Echinothurids, and has — as far as I am aware — not hitherto been observed in Cidarids. It also shows that the feature of the interambulacral peristomial plates reaching the mouth-edge or not is no reliable generic character.

Wyville Thomson (Op. cit. p. 67) remarks on *A. canaliculata* that »this species seems to acquire its full size during a single season. We dredged it at the close of the breeding season, and we took no specimens intermediate in size between the adult and the young». This suggestion is scarcely sufficiently well founded. First, the breeding season is — so far as I can find — not known with certainty; we do not know, whether the species does not breed all the year round, which is perhaps not unlikely (comp. *Sterechinus Neumayeri*, Echinoiden d. Deutschen Südpolar-Exped. p. 71). Further, it is certainly no definite proof that no intermediate sizes were taken in a few dredgings, especially in view of the fact that the Swedish Expedition secured specimens of all different sizes in a single dredging (St. 43). In case the species breeds all the year round or only a greater part of the year, it must be impossible to conclude anything in this direction from the size of the specimens caught, as then all the different sizes must be represented at any time of the year. The question, however, would certainly deserve a close investigation; we have otherwise no exact knowledge of the rate of growth of Echinoids.

Austrocidaris spinulosa n. sp.

Pl. III Figs. 3—5, Pl. XIV Figs. 3—5, 12—15.

	Diameter.	Height.	Apical system.	Anal system.	Peristome.	Width of		Number of plates.		Radioles.
						Ambulacra.	Interambulacra.	Ambulacra.	Interambulacra.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.
♀ . . .	27	17	12	7	8	3	13	35—36	7	49
	14	7.5	6.3	4	7	1.8	7	19—20	5—6	28
	11	6	5	3	6	1.5	5.5	15—16	5—6	20

This species, upon the whole, resembles *canaliculata* very much in the structure of the test. The height of the test and the relative size of the peristome and the apical system are in the larger specimen comparatively greater than in *canaliculata* at a corresponding size; but it is, of course, impossible to know, from the slight material available (only the three specimens whose measurements are given above), whether this is a constant feature. In the smaller specimens there is no distinct difference in these respects from specimens of *canaliculata* of a corresponding size. Like *canaliculata* it has not the test incurved at the edge of the peristome; on the other hand, it differs conspicuously from *canaliculata* in having the apical system flat, not sunken, and since the larger specimen is a female, evidently quite ripe and nearly fullgrown, there is every evidence that this is a specific feature.

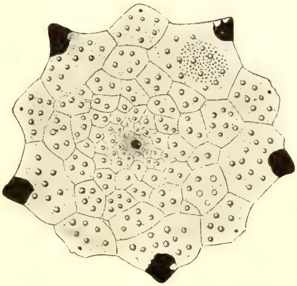

Fig. 6. Apical system of *Austrocidaris spinulosa.* $^{45}/_{1}$.

The ambulacra do not present any distinct difference from *canaliculata*, only the primary tubercles seem to be somewhat less prominent and the part of the ambulacral plate above the pores perhaps somewhat more elevated (Pl. XIV Fig. 3). The interambulacra are upon the whole as in *canaliculata*, though the areoles are, perhaps, a little larger than in that species, and the part of the plates between the areoles and the deep median line accordingly a little narrower. On the other hand, the number of the coronal plates seems to be smaller than in *canaliculata* — 7 in the larger of the specimens in hand against 8 in a specimen of 26 mm. diameter of *canaliculata*. This makes a conspicuous difference, the plates thus being comparatively higher in *spinulosa;* it is in accordance with this fact that the areoles on the actinal side are not so close together, at most 1—2 being confluent, whereas in *canaliculata* the 2—3 lower ones are confluent. Also the number of ambulacral plates corresponding to an interambulacral plate at the ambitus is a little larger, 7—8 against 6—7 in *canaliculata* of a corresponding size.

The apical system is, upon the whole, as in *canaliculata*, only the genital and ocular plates with the outer side somewhat less prominent; the large female genital openings also less intruding in the median interambulacral line (Fig. 6). In the specimen of 11 mm. diameter the ocular plates are still all excluded from the periproct; in *canaliculata* 2—3 ocular plates are in contact with the anal plates already at a size of 10 mm. diameter. The genital openings have not yet appeared in the specimen of 14 mm., whereas in *canaliculata* they have appeared at that size and are about to appear already in a specimen of 11 mm. diameter. — The anal area is flat in the young specimens, whereas in young *canaliculata* it is distinctly elevated. In the larger specimen it is, however, also somewhat elevated.

The peristome has the same character as in *canaliculata*, the interambulacral plates reaching the mouth-edge. There are 14—15 ambulacral plates on the peristome in the larger specimen; the smallest specimen has 7—8 ambulacral plates in each series, and the interambulacral plates do not fully reach the mouth-edge as yet.

The radioles are about twice the length of the horizontal diameter of test, thus considerably longer than usually in *canaliculata*. They further differ from those of *canaliculata* in being provided, in the lower part, with some conspicuous, irregularly arranged thorns (Pl. III Figs. 3—5); the outer part is set with numerous small thorns, arranged in longitudinal series, as in *canaliculata*. The structure of the radioles, as shown in sections, is the same as in *canaliculata*. The actinal radioles (Pl. XIV Figs. 4, 12—13) are not specialized; they are generally thorny, but may be quite smooth. The larger thorns occur only on the abactinal radioles. The secondary spines do not differ from those of *canaliculata* either in shape or in length.

The pedicellariæ differ only very slightly from those of *canaliculata*. In the large globiferous pedicellariæ the side-edges do not generally reach the opening (Pl. XIV Fig. 15), but this is not quite constant, and in *canaliculata* forms nearly approaching it may occur. The small globiferous pedicellariæ (Pl. XIV Figs. 5, 14) occur in a short and an elongate form, with transitional forms — much as in *canaliculata*. — The spicules of the tube-feet do not afford any feature of specific value.

The color as in *canaliculata*.

The three specimens were dredged at St. 58, South of West Falkland, at 52° 29′ Lat. S., 60° 36′ Long. W. in a depth of 197 m. (bottom sand and gravel; bottom temperature + 4°.1).

It may appear somewhat hardy thus to establish a new species of the genus *Austrocidaris*, seeing that the species *canaliculata* is maintained to be so very variable as also to include *Lorioli* as a synonym. That this alleged great variability of *canaliculata* is somewhat exaggerated, on account of the previous confusion with other species, I have shown above. That the length of the radioles may vary considerably in *canaliculata* I do not deny (though I should like to examine for myself some specimens of the longspined variety); but — so far as I know — no specimens have been described resembling *A. spinulosa* in the coarsely thorned upper radioles. This feature alone gives this species a very characteristic appearance, so that it is easily distinguished at the first glance. Also the smaller number of coronal plates and the not sunken abactinal area appear to me quite good specific characters, whereas the differences shown by the pedicellariæ are rather too inconspicuous to be of much value. — It may be possible, of course, that a larger series of specimens will reveal such as are intermediate between *spinulosa* and *canaliculata*. For the present, however, such intermediate forms are not known, and judging from the material at hand it is necessary to maintain *spinulosa* as a distinct species.

The fossil *Goniocidaris jorgensis* described by DE LORIOL (Notes pour servir à l'étude des Échinodermes. II. Ser. Fasc. I. 1902. p. 8) evidently also belongs to the genus *Austrocidaris*. The few isolated interambulacral plates — all that has been found of the species — show the inner edge smooth and depressed, »indiquant l'existence d'un sillon le long de la suture médiane des aires interambulacraires, identique à celui que l'on remarque dans le *Goniocidaris canaliculata* AL. AGASSIZ, par exemple». As the fossil species proceeds from the Lower Patagonian, probably belonging to the Eocene, we may herein see evidence that the genus *Austrocidaris* has originated in the same region, where it still lives (and the only region, where it occurs) — and it would seem not unreasonable to suppose that the *Austrocidaris jorgensis* is the ancestor of the recent species of the genus.

It may not appear very improbable to suggest that the *Cidaris julianensis* described by DE LORIOL from the same formation (Op. cit. Pl. I. Fig. 13) might be nearly related to the recent *Ctenocidaris speciosa*. The interambulacra are evidently very similar in structure, and the ambulacral pores, according to the figure given by DE LORIOL, are likewise separated only by a narrow wall. — This case is, however, not so evident as *Austroc. jorgensis*.

Fam. **Arbaciidae.** *

Arbacia Dufresnii (BLV.).

Pl. V Figs. 4—12. Pl. XV Figs. 2—3, 6, 8—10, 13.

Echinus Dufresnii BLAINVILLE. 1825. Dictionnaire d. sciences nat. Vol. 37. p. 75.
— — — 1834. Manuel d'Actinologie. p. 226

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* The mode of writing »Arbaciadae», used by AGASSIZ & CLARK is grammatically incorrect, in the same manner as »Echinometradae» for Echinometridae. It does not appear why they do not write also »Saleniadæ» etc.

Echinocidaris Scythei PHILIPPI. 1857. Neue Echinodermen d. chilenischen Meeres. Arch. f. Naturgesch. 1857. I. p. 131.

Arbacia Dufresnii A. AGASSIZ. 1872—74. Revision of Echini. p. 91, 399.

— — — 1874. »Hassler» Echinoidea p. 6. Pl. I. Figs. 3—4.

Echinocidaris (*Agarites*) *Dufresnii*. TROSCHEL. 1873. Die Familie der Echinocidariden. Arch. f. Naturgesch. XXXVIII p. 307. XXXIX. 1874. p. 319.

— — *alternans*. TROSCHEL. 1873. Die Familie der Echinocidariden p. 307, II. p. 323.

Arbacia Dufresnii. STUDER. 1876. Über Echinodermen a. d. antarktischen Meere und zwei neue Seeigel von den Papua-Inseln, gesammelt a. d. Reise S. M. S. Gazelle um die Erde. Monatsber. d. Berl. Akad. p. 456.

— *alternans*. STUDER. Ibidem.

— *Dufresnii*. STUDER. 1880. Übersicht über die während d. Reise S. M. S. Corvette Gazelle um die Erde 1874—76 gesammelten Echinoiden. Monatsber. Berl. Akad. p. 867. Taf. I. Fig. 2.

— *alternans*. STUDER. Ibidem. Taf. I. Fig. 3.

Echinocidaris Dufresnii. F. JEFFR. BELL. 1881. Account of the Zoological Collections made during the survey of H. M. S. 'Alert' in the Straits of Magellan and on the Coast of Patagonia. IX. Echinodermata. Proc. Zool. Soc. p. 87.

Arbacia — A. AGASSIZ. 1881. Challenger-Echinoidea p. 58 (pro parte).

— — LOVÉN. 1887. Echinoidea described by Linnæus. Bih. till K. Svenska Vet.-Akad. Handl. Bd. 13. Afd. IV. N:o 5 p. 117.

— *alternans*. LOVÉN. 1887. Ibidem p. 116.

— *Dufresnii*. 1895. F. BERNARD. Échinides recueillis par l'expédition du Cap Horn (1882—1883). Bull. du Muséum d'hist. nat. 1895 N:o 7 p, 2.

— — 1896. M. MEISSNER. Die von Herrn Dr. Plate aus Chile heimgebrachten Seeigel. Arch. f. Naturgesch. Jahrg. 62. I. p. 83.

— — 1900. M. MEISSNER. Echinoiden d. Hamburger Magalhaensischen Sammelreise p. 5.

— — 1904. P. DE LORIOL. Notes pour servir à l'étude des Échinodermes. 2 Ser. II. p. 8. Pl. II. fig. 2—5.

* — — 1905. C. E. PORTER. Los equínidos chilenos del viaje del buque esplorador »Challenger» estractados y adicionados de varias notas. Revista chilena. IX. p. 131.

— — 1906. R. KOEHLER. Stéllérides, Ophiures et Échinides. Expédition antarctique Française. Dr. Charcot. p. 29.

— — 1908. A. AGASSIZ & CLARK. Hawaiian and other Pacific Echini. The Salenidæ, Arbaciadæ . . . Diadematidæ. Mem. Mus. Comp. Zool. XXXIV p. 69. Pl. 47. Figs. 1—11.

Non: *Echinocidaris africana* TROSCHEL.

This species, so very easily recognizable from its beautiful green colour, has been so carefully described in the works quoted, especially by TROSCHEL, LOVÉN and DE LORIOL, that there is no reason to give a full description of it here again; only a few remarks must be given, on account of the question of the specific validity of *Arbacia alternans*, and likewise on account of the new species, *A. crassispina*, here distinguished from *A. Dufresnii*, with which species it has hitherto been confounded.

The shape of the test is rather variable. As seen by the measurements given here, the height varies very considerably. LORIOL's statement (Op. cit. p. 9) »test toujours déprimé» accordingly does not always hold good; the fact that all DE LORIOL's specimens came from a single locality may account for their uniformity. The outline of the test at the ambitus is generally angular, the ambulacra forming the prominent edges; sometimes, however, the interambulacra form the edges, and other specimens may be quite round.

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* Not seen by the author; quoted from Zoological Record 1905.

Diameter.	Height.	Apical system.	Anal system.	Peristome.	Width of		Number of plates.		Longest spines.
					Ambulacra.	Interambulacra.	Ambulacra.	Interambulacra.	
mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.
50	28	13	7—6	24	8	23	21—22	17	30
48	26	13	7—6.5	24	8	22	19—20	15—16	22
41	30	11	6.5—5.8	18	7	19	22—23	17—18	25
37	21	11	5·5—4·5	20	7	16	19—20	15—16	?
37 *	16	10	5—4·5	20	5·5	16	19—20	14—15	?
31	16	8.5	4·3—3·2	16	5	13·5	18—19	14	16
29	15	8.5	4—3·5	15	5	12.5	18—19	14—15	15
18	8.5	6.5	3—2.5	10	3·5	7·5	12—13	10—11	?
18	8	6.5	2.6—2.2	10	3·2	8	13	10—11	?
14	7	6	2.8—2.2	8	2.5	6	12	10	?

The tuberculation is upon the whole fairly constant. All the specimens have a broad bare interambulacral space on the abactinal side. Secondary tubercles are scarcely found on the abactinal side, at most a small one near the primary tubercle on 2—4 plates above the ambitus. — The development of the epistroma round the primary interambulacral tubercles and in the ambulacra is rather variable, upon the whole not very strong (Pl. XV Fig. 3).

The genital openings appear early; they are present in the youngest specimen in hand, 14 mm. diameter. They lie mostly nearer to the middle of the plate than to the apex; so close to the apex as in the specimen figured in the »Hassler» Echini, Pl. I. Fig. 4, I have never seen them. In some few specimens I have found a double pore in one of the plates. — The ocular pore is generally not to be seen from above, a knob growing out and covering it. This knob is connected with the outer end of the plate across the pore, and a partition wall is formed which may continue down into the ocular pore, which is thus divided into two more or less distant pores. The same peculiar structure — first described by LOVÉN in *Tetrapygus niger* (*Echinocidaris nigra*) (Études s. l. Éch. p. 67) — is found in the other species of *Arbacia*, more or less developed. In the *A. crassispina*, described below, this feature is especially prominent (Pl. XV Figs. 9, 11). — Though generally the ocular plates are widely excluded from the anal area, exceptions may occur; of three specimens from Ultima Esperanza (Fuegian Expedition 1896) two have two of the ocular plates in broad contact with the anal area, and the third specimen has one ocular plate almost in contact with the anal area. These specimens do not otherwise differ from the typical ones. — The anal plates are always arranged in the same manner, the short diagonal going from about the middle of the madreporite to the ocular V. This position of the anal plates appears to be the rule in the *Arbaciidæ*, except, of course, those with 5 anal plates (*Pygmæocidaris*, *Habrocidaris*).

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* Type-specimen of *A. alternans* (TROSCHEL)

TROSCHEL, in his description of *A. Dufresnii* (Op. cit. p. 321), mentions »haarförmige Stachelchen» which are carried by the small granules between the tubercles. Also DE LORIOL (Op. cit. p. 11) says that »les radioles des granules ont l'apparence de soies assez longues, d'une délicatesse extrême». It is quite beyond doubt that these »spines» are only the pedicellariæ (or the stalks of pedicellariæ which have lost the head).* Small thin spines upon the whole do not occur in the *Arbaciidæ;* also the short secondary spines are thick and coarse.

The pedicellariæ I find, upon the whole, as described and figured by AGASSIZ & CLARK. They are, however, somewhat variable. In one of the specimens from the Fuegian Expedition ($^{23}/_{1}$ 96) the tridentate pedicellariæ have a peculiar form (Pl. XV Fig. 13), being somewhat abruptly widened above the basal part; but in other specimens from the same locality they have the typical form shown by the fig. 5 Pl. 47 in AGASSIZ & CLARK's work. The ophicephalous pedicellariæ generally are of the form figured by AGASSIZ & CLARK (Pl. 47. Fig. 7) but another form (Pl. XV Fig. 6) also occurs, though much less numerously, in which the blade is only about half the length of the basal part. The upper end of the stalk of the ophicephalous pedicellariæ I find somewhat different from the figure given by AGASSIZ & CLARK (Pl. XV Fig. 10 to compare with Pl. 47. Fig. 4 in the work of AGASSIZ & CLARK). Also the triphyllous pedicellariæ I find a little different from the figure given by AGASSIZ & CLARK (Fig. XV Fig. 2 to compare with Pl. 47. Fig. 6 in AGASSIZ & CLARK's work). This figure shows a broad coverplate passing upwards along the sides of the blade; I have seen nothing like that in my preparations. In the text the authors say (p. 69) that there is no »coverplate», in contradiction to the figure. Otherwise I may only remark that the triphyllous pedicellariæ are finely serrate along the edge of the valves.

AGASSIZ & CLARK state that »calcareous particles appear to be quite wanting in the walls of the pedicels, except for the terminal rosettes and their supporting rods in those of the actinal surface». I have, however, in some cases found some few spicules in the upper part of the tubefeet; they are more or less irregular, with some perforations in the broader middle part (Fig. 7).

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* CH. DESMOULINS (Sur les épines des Échinodarites. Act. Soc. Linn. Bordeaux T. XXVII. 1869. p. 5) also describes such »*épines piliformes* .... qu'on oserait à peine nommer *miliaires*», which are evidently likewise the stalks of pedicellariæ.

This species was taken by the Expedition only at Station 2, the coast of North Argentina (37° 50′ Lat. S. 56° 11′ Long. W. 100 m.); 4 large, high specimens. From the Fuegian Expedition there are several large and small specimens from Bahia inutil, 1—11 fathoms, $^{23}/_{\mathrm{I}}$ 1896, Ultima Esperanza, 7—10 fathoms, stones, algæ, 3 specimens, Puerto Madryn, 5 fathoms, sand-clay bottom, $^{10}/_{\mathrm{XI}}$ 1895; 5 specimens.

The question whether *Arbacia alternans* (TROSCHEL) is only a synonym of *A. Dufresnii* or represents a distinct species, has been very much discussed and a general agreement has not been reached as yet. LOVÉN decidedly regards *A. alternans* as distinct, as does also STUDER. Likewise it is named as a separate species by MEISSNER in BRONN's »Classen u. Ordnungen d. Tierreichs», Echinoidea p. 1360. DE LORIOL (Op. cit.) maintains that in the characters of the tuberculation of the abactinal side — the character upon which *alternans* is mainly established — no constant difference can be found, but he thinks the characters in the pedicellariæ pointed out by STUDER »bien plus que l'arrangement des tubercules doivent engager à maintenir l'*A. alternans* comme espèce distincte». AGASSIZ (»Challenger» Echinoidea) evidently regards *alternans* as synonymous with *Dufresnii*, since he does not mention the former in his list of the known species of recent Echini (p. 209).

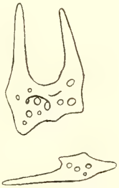

Fig. 7. Spicules from the tubefeet of *Arbacia Dufresnii.* $^{125}/_{1}$.

In the latest, very important, contribution to the knowledge of this group of Echinoids, viz. AGASSIZ & CLARK's »Hawaiian and other Pacific Echini. The Arbaciadæ etc.» both *alternans* and *africana* TROSCHEL are regarded as synonyms of *Dufresnii* (p. 68), with the reservation that »it is possible that further material from the west coast of Africa will make the recognition of the species *africana* TROSCHEL desirable, and there is also a possibility that *alternans* TROSCHEL may ultimately be separable from *Dufresnii* BL.» (p. 67). — There is thus evidently upon the whole a tendency towards maintaining *alternans* as a distinct species.

From the Berlin Museum I have received the type specimens of TROSCHEL's *alternans* for renewed examination. The largest of them is represented in Pl. V. Figs. 6—7. Further I have received, through the kindness of Professor THÉEL, a specimen in the collection of the Stockholm Museum, identified by LOVÉN as *alternans.* A very careful examination and direct comparison of these specimens with the specimens of *A. Dufresnii* in hand has convinced me that it is impossible to maintain *alternans* as a distinct species.

The alternation of the primary abactinal interambulacral tubercles, upon which character *alternans* was mainly distinguished, is decidedly without value as a specific character, being exceedingly variable, as sufficiently shown by DE LORIOL. As a matter of fact I find this irregularity in the abactinal series of primary interambulacral tubercles more or less developed in *all* the specimens examined by me, not a single one having a quite regular series (viz. with a large tubercle on every plate, gradually diminishing in size towards the apical system). In several cases the primary tubercle has even wholly disappeared on every second abactinal plate. *

STUDER (Op. cit. 1880) points out a considerable difference in the structure of the pedicellariæ as a distinguishing feature between *alternans* and *Dufresnii* (Taf. I. Fig. 2, 3). DE LORIOL is inclined to see likewise a real difference herein. STUDER's figures give, however, the proof that these differences, though conspicuous enough, are without any value for the purpose of distinguishing *alternans* from *Dufresnii*, because one (Fig. 2) represents an ophicephalous, the other (Fig. 3) a tridentate pedicellaria. Real, constant differences in the pedicellariæ by which two species might be distinguished I have been unable to find. STUDER further states that the spines of *alternans* are more pointed than those of *Dufresnii*. I am unable to see any difference in the spines either; they certainly vary somewhat both in length and thickness, but these variations are too inconsiderable and inconstant to be used as specific characters.

In the careful description of *Dufresnii* and *alternans* given by TROSCHEL (Op. cit.) only two more important differences are pointed out, viz. that of the tuberculation, which has been shown to be non-existent and the colour, *alternans* being stated to be brown, which would certainly be a very conspicuous difference from the eminently characteristic green colour of *Dufresnii*. It is quite true that the colour of the type specimens of *alternans* was brown, but this depended on their being insufficiently cleaned. On cleaning them I find the colour to be green as in *Dufresnii.* (Also Lovén states *alternans* to be green.) In the elaborate description of the two species given by Lovén I am likewise unable to find any other more important difference indicated than that of the tuberculation.

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* In the »Hassler» Echini (p. 7) AGASSIZ speaks of »the property possessed by the Arbaciadæ of resorbing at any time during their growth the primary abactinal interambulacral tubercles, and changing them into a sort of chagrin, or finely granular, nearly bare abactinal star». — Such a resorption of tubercles (with the spine, muscles etc.) and the transformation of them into epistroma (which seems to me to be the meaning of the sentence quoted) is highly improbable and — as far as I know — quite without any proof. It is further quite unnecessary for understanding the alternation of the tubercles in this and other species of Echini. The fact is that no tubercle and spine is ever formed on the plates lacking them in grown specimens. This may be easily confirmed on examining somewhat carefully the upper plates in young specimens. Whereas thus the alleged property of resorbing the tubercles and transforming them into epistroma appears very improbable and without any supporting facts and observations, the inverse case, viz. the resorption of the epistroma and its use partly in the formation of the tubercles, seems put beyond doubt through the beautiful researches of LOVÉN on the changes undergone by the test of the young *Arbacia lixula* (*æquituberculata*) (Echinoidea descr. by Linnæus, p. 86—94).

I may recall here my note (»Ingolf» Echinoidea II. p. 41) on the alleged resorption of injured spines in *Urechinus* described by AGASSIZ (Panamic Deep Sea Echini p. 153, 159—60). That any resorption has taken place in these cases is highly improbable, and no facts tend to show it. Most probably the cases described by AGASSIZ are only the results of the rough treatment of the specimens in the dredge. It may also, to more or less extent, be due to autotomy. Though hitherto not known in the Echini autotomy has now been proved to occur also here through the beautiful researches of O. POSO. (Ricerche biologiche ed istogenetiche sugli Echini regolari. Archivio Zoologico. II. 1909. p. 463).

It is my decided opinion therefore that *alternans* cannot be maintained as distinct from *Dufresnii*, not even as a variety.

With *Arbacia africana* (Troschel) the case is different. The type specimens appear to have become lost. They are no more in the collections of the University in Bonn, and not in Stockholm either, where Lovén once had them for examination. On the other hand I have received from the Berlin Museum the specimens mentioned by Lovén (Op. cit. p. 105), as also another specimen in alcohol (2310; Schinehoxe; Africanische Gesellschaft). As these specimens (in any case the dried ones) have been directly compared with the type specimens by Lovén, we may safely assume that they really belong to *A. africana.*

A mere glance at these specimens (one of them represented in Pl. V. Figs. 13—15) shows that they have nothing at all to do with *A. Dufresnii.* The abactinal interambulacral tubercles are strongly developed and cover most of the interambulacral area, leaving only a small space naked, just as in *A. lixula.* The colour of the test is reddish or brownish, with a faint olive tint, very different from the green colour of *Dufresnii.* The spicules are like those of *A. lixula.* The pedicellariæ show only unimportant peculiarities; tridentate pedicellariæ were not found.

From what has been pointed out here, as well as from the figures given (Pl. V Figs. 13—15) it is evident that *A. africana* has nothing to do with *A. Dufresnii.* It is decidedly nearest related to *A. lixula* — if not a synonym only of that species. To decide this question more and better material would be desirable; on this occasion I must content myself with having shown that the alleged synonymy of *A. africana* with *A. Dufresnii*, so highly improbable from a zoogeographical point of view, was really erroneous.

The geographical distribution of *Arbacia Dufresnii* is thus again restricted to the South American Coasts, where it is known to range from the southern extremity to the La Plata River (37° 42′ S. »Hassler» Echini) on the East Coast, and to 42° S. on the West Coast (Puerto Montt; Plate (Meissner)). Further it was taken by the French Antarctic Expedition (Exp. Charcot) at the Island Booth Wandel near the Antarctic Continent. — The bathymetrical range of the species, as far as known, is from the shore down to 175 fathoms (»Challenger»).

In the »Challenger» Echinoidea (loc. cit.) *Arb. Dufresnii* is further mentioned from Nightingale Island (Tristan da Cunha), 100—150 fathoms. This occurrence would be easily explained, if the species had pelagic larvæ; but this seems not to be the case. Studer (»Gazelle» Echinoidea p. 868) gives the following statement:

»Beim Eierlegen beobachtete ich, dass die winzigen Eier, welche in continuirlichen Massen den Genitalporen entströmten, zunächst auf die nackten Interambulacralplatten gelangten und dort sich vertheilten. Sie blieben hier auf der Schalenoberfläche an der Sculptur der Schalen haften.» Another important observation was made by Bernard (Op. cit.): »*A. Dufresnii* est *incubateur;* j'ai trouvé sur un exemplaire de moyenne taille un jeune Oursin de 6 millimètres logé dans un enfoncement de la membrane buccale; les cinq zones ambulacraires étaient enfoncées de même.» *A. Dufresnii* thus appears not to have pelagic larvæ. * (None of the specimens in hand carry young ones on the peristome.) The statement of the occurrence of the species at Nightingale Island thus becomes less probable — and fortunately I am able to prove that it is wrong, resting on incorrect identification. Having received a specimen from Nightingale Island from the British Museum I was at once struck with the considerable difference in the general habitus between this specimen and the specimens from South America, and a careful examination has shown that it is by no means identical with *A. Dufresnii*. It makes a very distinct new species, which I shall describe and figure here under the name:

Arbacia crassispina n. sp.

(Pl. V. Figs. 1—3, Pl. XV. Figs. 1, 4—5, 7, 11, 14.)

Diameter.	Height.	Peristome.	Apical system.	Anal system.	Width at ambitus of		Number of plates.		Longest spines.
					ambulacra.	interambulacra.	Ambulacra.	Interambulacra.	
45 mm.	22 mm.	24 mm.	11 mm.	6.8—5 mm.	8 mm.	19 mm.	20—21	15—16	30 mm.

The shape of the test is somewhat low; the circumference round. On the abactinal side the interambulacra are slightly sunken towards the apical system, the ambulacra thus being slightly prominent.

The ambulacral primary tubercles increase regularly in size from the peristome towards the ambitus; above the ambitus large and small tubercles alternate irregularly.

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* In the list of the Antarctic Echinoids, which are known to be »viviparous» (strictly taken this word is not correct here, where it means only »care of the brood»), given in the Report on the Echinoidea of the German South Polar Expedition (Ergebn. d. deutschen Südpolar-Exped. IX. Zoologie III. p. 104) *A. Dufresnii* is not included, as I had forgotten Bernard's observation. Likewise Ludwig appears to have overlooked this observation, this species being not included in the list given in his paper »Brutpflege bei Echinodermen» (Zool. Jahrb. Suppl. VII).

It would be very desirable to have the observation by Bernard on the viviparous habit of this species confirmed. It cannot be denied that this occurrence of *one* young on the peristome is somewhat remarkable in view of the evidently enormous number of eggs. Can it perhaps be that this young one had accidentally got on the peristome during the capture in the dredge or even in the preserved state? In any case it would be very desirable to have the question reexamined.

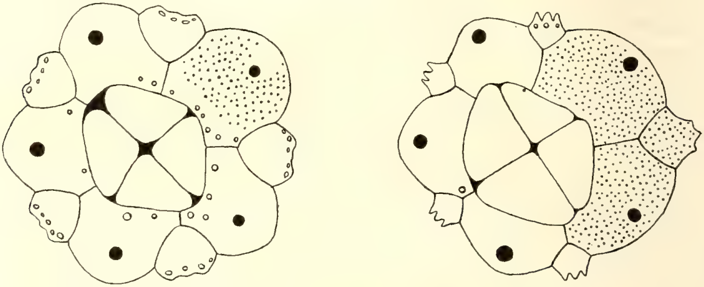
This change in size of the tubercles above the ambitus looks not so abrupt as in *A. Dufresnii*, on account of the occurrence of larger tubercles between the small ones. Near the apical system the two series become irregular, as is commonly the case in the species of *Arbacia*. The large tubercles at the ambitus occupy the whole height of the compound plate, the upper and lower edge of their base being more or less straight. The side of the tubercle-base looking towards the pores is somewhat deeply indented. The median line of the ambulacra is covered by numerous small miliary tubercles carrying pedicellariæ. The pores are arranged in a somewhat sinuating line. The epistroma is very strongly developed above and outside each pair of pores (on the abactinal side) — a conspicuous difference from *Dufresnii*, where it is very slightly developed (Pl. XV Fig. 1 to compare with Pl. XV Fig. 3). Towards the peristome the pore area widens very considerably, being twice as broad as the interporiferous zone, and the whole ambulacral area is at the edge of the peristome twice as broad as the interambulacral area.

The interambulacral plates carry at the ambitus each three large tubercles, sometimes with a small fourth tubercle at the inner edge; there are thus 6 vertical series of interambulacral tubercles. The 2—3 plates immediately above the ambitus carry each four tubercles, gradually diminishing in size from the outer towards the inner one. The third of these tubercles continues until the 4—5th plate from above, the second continues up to the apical system, only on the uppermost plate it has not yet appeared. The outer series likewise continues to the apical system, without any interruption; the tubercles gradually diminish in size, only exceptionally a single tubercle may occur, which exceeds the one immediately below somewhat in size. — The space between the primary tubercles is on the actinal side occupied by small miliary tubercles, carrying pedicellariæ; on the abactinal side a fairly well developed epistroma occupies the part of the plates not covered by the tubercles, together with the white miliary tubercles, carrying pedicellariæ, scattered between the elevations of the epistroma. — The inner edge of the plates is finely granular. — The strong development of the abactinal interambulacral tubercles (and spines), leaving scarcely any naked median space, forms a most conspicuous difference from *Dufresnii*, which latter species has always a very large naked space in the interambulacra on the abactinal side. (Pl. V Figs. 2—3 to compare with Pl. V Figs. 4—7, 9—12.)

The apical system upon the whole bears a considerable resemblance to that of *Dufresnii;* the shape of the genital plates is alike, and the ocular plates are all excluded from the anal area as in that species (Figs. 8—9). The shape of the ocular plates, however, differs from that in *Dufresnii;* the outer sides are longer and somewhat concave, and the whole plate is conspicuously smaller than in *Dufresnii;* also the outer edge is somewhat different (Pl. XV Fig. 11 comp. with Pl. XV Fig. 9). The ocular pore is, as usually in *Arbacia*, covered by a prominent tubercle. The anal system as usual (one of the plates is abnormally divided into three smaller plates; not shown in the text figure); the anal plates form a rather conspicuous pyramid, are not flat as in *Dufresnii*. The whole apical system finely striated granulated as in *Dufresnii*. — The apical system of the specimen in hand affords the curious, evidently abnormal feature that the madreporic pores have spread over the adjoining ocular plate II and genital plate 2 (Fig. 9).

The peristomial membrane encloses rather numerous, small, smooth plates; a few larger plates outside the buccal plates carry numerous pedicellariæ like the buccal plates. — The gill-plate is short, not longer than wide, and not pointed distally.

The spines are thicker and coarser than in *Dufresnii;* the cap generally has three or more distinct longitudinal ridges, while in *Dufresnii* there are generally only two (Pl. XV Figs. 4, 8). I would, however, doubt that a constant specific difference could be found herein. In sections of the spines a slight difference is likewise seen between this species and *Dufresnii;* the solid wedges in the periphery having completely disappeared, whereas they are generally distinct in *Dufresnii* (Figs. 10—11). The secondary abactinal spines are short and thick, clubshaped. — The close covering of spines makes the species look very different from *Dufresnii*.


Figs. 8—9. Apical system of *Arbacia Dufresnii* (8) and *A. crassispina* (9). 5/1.

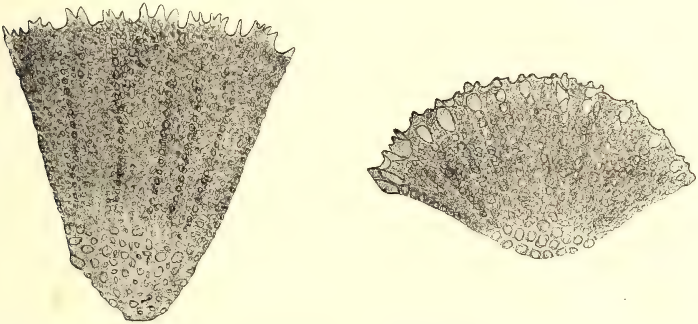
The pedicellariæ are, upon the whole, very like those of *Dufresnii*. The ophicephalous pedicellariæ occur in two forms (Pl. XV Figs. 5, 7) as in *Dufresnii* and afford only unimportant differences from those in that species; the stalk is alike. The tridentate pedicellariæ (Pl. XV Fig. 14) perhaps a little less elongate than in *Dufresnii*. No triphyllous pedicellariæ were found.

Spicules appear to be entirely wanting in the tubefeet in the specimen in hand.

The colour of the test (abactinal side) is dark green, the tubercles white. The spines of the single, dried specimen in hand are gray, those on the actinal side with a slight reddish tint towards the tip and a faint greenish tint at the base.

It will doubtless be agreed that the characters here pointed out, especially the numerous abactinal interambulacral tubercles and spines, the robustness of the spines and the shape of the ocular plates, make this a very well characterized species. It seems to be nearest related to *Dufresnii* (the green colour, the lack of spicules); the close tuberculation reminds one of *A. lixula*, but with this species it is scarcely more nearly related.

Though I have not seen any of the other specimens from Nightingale Island, I think it will not be too hardy to suggest that they also belong to this species. This locality is then to be removed from *Dufresnii*, which is known with certainty alone from the South American Coasts, as explained above (p. 31) and from the Antarctic Coast opposite the extremity of South America.



Figs. 10—11. Transverse sections of spines of. *Arbacia crassispina* (10) and *A. Dufresnii* (11).

In the above quoted work of AGASSIZ & CLARK: »Hawaiian and other Pacific Echini. The Salenidæ, Arbaciadæ . . . .» it is stated (p. 109, Note) that in my discussion of the systematic value of the character afforded by the ambulacral structure of the regular Echinoids (Siam-Echinoidea I. p. 42), the result being that the three main types of ambulacral structure, viz. the cidaroid, the diadematoid and the echinoid type, must be regarded as characters of orders, I have made a curious slip, having overlooked that DUNCAN & SLADEN have shown the ambulacra of *Tetrapygus* to be of the echinoid structure, not of the diadematoid, as are those of the other Arbaciids. They conclude the note with the remark: »Are we to presume that Dr. Mortensen will establish a family »Tetrapygidæ» under his »Tribus 4. Echinina» for this aberrant genus?»

It is true that I have overlooked DUNCAN & SLADEN's statement * about the ambulacra of *Tetrapygus*, and I have no excuse for that. But I might suggest that it had been better to reexamine the question, than to suggest that I would be so foolish as to place *Tetrapygus* in another family than the Arbaciidæ. Certainly the figure given by Duncan & Sladen does not look very convincing. — I have carefully examined the ambulacral structure of *Tetrapygus niger* and find that Duncan and Sladen were wrong in their statement; it is not of the echinoid type (Pl. XV Figs. 12, 15). A comparison with the ambulacral plates of an *Arbacia*, e. g. *A. Dufresnii* (Pl. XV Fig. 3), leaves no doubt that the demi-plate immediately below the large primary plate is the lower component of the compound plate. *Tetrapygus niger* thus differs from the genus *Arbacia* in regard to the ambulacra only in the augmentation of the demi-plates above the large primary plate — it is of the diadematoid type, as might be supposed beforehand. My view of the importance of the ambulacral structure in regular Echinoidea is not altered.

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* On the Family Arbaciadæ GRAY. Part I. The Morphology of the Test in the Genera Coleopleurus and Arbacia. Journ. Linn. Soc. Zoology. Vol. XIX p. 53. Pl. II. 6.

Fam. **Echinidæ.**

Notechinus magellanicus (Phil.).

Pl. XVI Figs. 3, 6, 9—12, 19.

? *Echinus margaritaceus* Lamarck. 1816. Animaux sans vertèbres. III. p. 47.
? — — 1846. Voyage de la Frégate Vénus. Pl. VI. Fig. 1.
— *magellanicus* Philippi. 1857. Vier neue Echinodermen des chilenischen Meeres. Arch. f. Naturgesch. p. 130.
— — A. Agassiz. 1872—74. Revision of Echini p. 123, 492.
— — — 1874. Echinoidea of the Hassler-Expedition p. 11. Pl. III. Fig. 5
— *margaritaceus.* — — — — — — p. 11. Pl. III. Fig. 4.
— *magellanicus.* F. Jeffr. Bell. 1881. Echinodermata of the »Alert». Proc. Zool. Soc. p. 90—91.
— — M. Meissner. 1900. Hamburger Magalh. Sammelreise p. 10.
— — R. Koehler. 1901. Échinides et Ophiures. »Belgica» p. 4.
Sterechinus — Th. Mortensen. 1903. »Ingolf» Echinoidea. I. p. 103, 177. Pl. XIX. Figs. 11, 17, 23.
Echinus — De Loriol. 1904. Notes pour servir à l'étude des Échinodermes. 2 Ser. Fasc. II. p. 13. Pl. I. Figs. 7—9.
— — R. Koehler. 1906. Stéllérides, Ophiures et Échinides. Expédition antarctique Française (1903—1905) p. 30, 35.
Notechinus — L. Döderlein. 1906. Echinoiden d. deutschen Tiefsee-Expedition p. 227. Taf. XXVII, Fig. 9, XXVIII, Figs. 3—4, XXXV, Fig. 15, XLVII, Fig. 5.
— —, var. *neu-amsterdami* Död. 1908. Koehler, Stéllérides, Ophiures et Échinides. Expéd. antarct. nat. Écossaise. Trans. R. Soc. Edinb. XLVI. p. 616.
Non: *Echinus magellanicus.* Ramsay. 1885. Cat. Echinod. Australian Museum. I. p. 21.
— — Farquhar. 1898. On the Echinoderm Fauna of New Zealand. Proc. Linn. Soc. N. S. Wales p. 320.
— — Hutton. 1904. Index Faunæ Novæ Zelandiæ p. 289.

This very characteristic species has been so carefully described, especially by De Loriol and Döderlein, that only very little additional information can be given. Döderlein (Op. cit. p. 230) has given measurements of some specimens; as, however, most of these are calculated in percent I give here some direct measurements, finding that it may not infrequently be preferable to have the direct instead of the percent numbers; further these measurements will be of importance for judging of the value of the varieties of this species established by DÖDERLEIN.

	Diameter.	Height.	Peristome.	Apical system.	Anal area.	Width of		Number of plates.		Longest spines.	Ocular plates contiguous with the anal area.
						ambulacra.	interambulacra.	Ambulacra.	Interambulacra.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.	
Stat. 44	40	25	10	13	6.5	9.5	16	25	18—19	7	II, V.
	38	24	11	12	6	9	14.5	25—26	19—20	10	I, V.
	37	27.5	10	12	6	9	14	24—25	18—19	8	I, II.
	36	22	10	12	7	9	13	24—25	17—18	—	I, II.
	36	20.5	11.5	10.5	6	9	13.5	23—24	18—19	—	I.
Stat. 2	30.5	16.5	9.5	10	6	7.5	11.5	21	15—16	—	I.
	27.5	16	8.2	8	4	7	10	20	15—16	—	I.
	26	14.5	8.5	8	4.2	7	9.5	19—20	14—15	9.5	I.
	26	13.5	8	7.8	5	7	9.5	19—20	15	11	I.
	25	15	8	7	4	7	9	20—21	16	8	I.
	24.5	14.5	9	7.2	3.5	6.2	9	21	15—16	—	I.
	24	14.5	8.2	7	3.5	6.5	8.8	20	16	—	I.
	24	14	8	7.5	4.5	6	9	20—21	16	9.5	I.
	22	13	7	7.5	4	6	8	19	14	9	I.
	16	9.5	6.5	5	2.5	4.5	5.2	17	12—13	—	I.
Isthm. Bay	26	16	9	6.5	3.5	6.2	9.6	24—25	17—18	—	I.
Ultima Esperanza	24.5	15	7.8	6.8	3	6	9	23	15—16	—	I.
	23	13	7.5	7.5	3.5	6	8	21	16—17	—	I.
	23	13.5	7.5	8	3.5	5.8	8	20	14—15	5.5	I.
	22	14.5	7	7.2	3.8	6	7.5	20—21	16—17	10	I.
	21.5	13	7.5	6.5	2.5	5.5	8.2	20	15	6.5	0.
Stat. 3	21.5	11.5	8.5	5.8	3	5.2	7.6	19	14—15	—	I.
	17	10	6.8	5	2.6	4.5	6	18—19	14	—	I.

Concerning the tuberculation it may be remarked that the secondary tubercles are, upon the whole, very varying in size and number; in some specimens they form very conspicuous vertical series, in others they are all of almost uniform small size, scarcely forming distinct vertical series. The areoles of the primary interambulacral tubercles are small and, generally, not in contact, except a few of those nearest the peristome; even at the ambitus they are separated by a series of miliary tubercles. In the ambulacra the areoles are generally in contact, probably always at the ambitus, at least in larger specimens, sometimes along the whole series from the peristome to the apical system.

As pointed out by DÖDERLEIN it is the ocular plate opposite the anal opening (ocular I) which is in contact with the periproct; there is, however, some variation in this respect. In the larger specimens it seems to be a general case that two ocular plates are in contact with the anal area, viz. I and II or I and V, or even II and V; the latter case is found also in the specimen figured by DÖDERLEIN, Pl. XXVII Fig. 9. Seldom all the ocular plates are excluded from the periproct, except in the quite young specimens. In a specimen of 4 mm. diameter the ocular plate I is still excluded, but reaches very near to the edge. At this size the genital pores have not yet appeared, and the anal plate covers almost the whole anal area, only a pair of small plates having just appeared at its anal edge. At a size of scarcely 5 mm. diameter the genital pores have appeared. — In one of the largest specimens there are in the genital plates 1, 3 and 4 some small pores near the genital pore, which quite look like supplementary madreporic pores; but as the specimen had been dried, before I remarked these small pores, I dare not affirm that they are really madreporic pores. In another specimen, however (40 mm. in diameter, stat. 44), I find a small group of undoubted madreporic pores in the two plates adjoining the madreporite, Ocular III and Genital 3, so here we have an extension of the madreporite (Fig. 12).

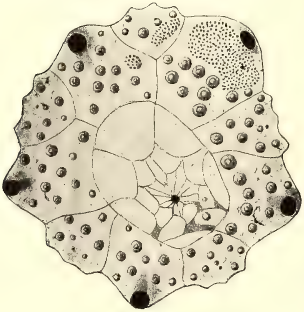

Fig. 12. Apical system of *Notechinus magellanicus*, with abnormal development of the madreporic pores. $^5/_1$.

In the young specimens the buccal plates show the feature that only one tubefoot is developed in each pair; the second tubefoot appears at a size of 2.5—3 mm. diameter. This late appearance of the second tubefoot probably is the rule among the Echinina [comp. e. g. *Hypsiechinus coronatus* (»Ingolf» Echinoidea I. p. 89), *Sterechinus Neumayeri* (Echinoidea d. deutschen Südpolar-Exped. p. 70)].

The primary spines are smooth, as stated by DÖDERLEIN; only in the young specimens they are more or less thorny. DE LORIOL says that they are »nullement arqués»; as I have stated in the »Ingolf» Echinoidea, and as also maintained by DÖDERLEIN, they are really more or less distinctly curved near the actinostome, though not so much so as in the *Sterechinus* species. The secondary spines are often somewhat thickened in the point, not so very like those of *Sterechinus Neumayeri*, as I have stated in the »Ingolf» Echinoidea I. p. 103. To DÖDERLEIN's description I may only add that there is no central thorn in the point; only the point of the spine is thorny (Pl. XVI Fig. 6). — I have been unable to find embryonal spines in the smallest specimen in hand, 1.4 mm. in diameter. The primary spines of the young specimens (Pl. XVI. Fig. 12) are thorny and end in a distinct central thorn; this is also to be found in the grown specimens, if only the spines are unbroken, which is, however, comparatively seldom the case, they being very fragile. Spines with the outer part regenerated are very commonly seen; also in such spines the central thorn may be distinct. The secondary spines of the young specimens are also thorny and have a small central thorn in the point (Pl. XVI. Fig. 11).

The spicules (Pl. XVI. Fig. 9. a) are not very numerous; they are very slender, bihamate. Also such spicules occur, which are not bent at the ends (Pl. XVI. Fig. 9. b); they are probably developmental stages of the usual form. No spicules are found in the walls of the intestine, axial organ or genital organs; the latter are not coalesced.

Concerning the pedicellariæ I must refer to the description given in the »Ingolf» Echinoidea and by DÖDERLEIN (Op. cit.). The interesting observation was made by DÖDERLEIN that this species has two kinds of globiferous pedicellariæ, a larger and a smaller one, the latter generally with only one lateral tooth. I have found this small form * to occur constantly, though in varying numbers; sometimes it is rather plentiful, sometimes very scarce, especially among the specimens from Stations 2 and 44 it even appears to be totally wanting in a few of the specimens. It is mainly found on the abactinal side. It is an interesting fact that both forms of globiferous pedicellariæ have double poison glands, while in *Sterechinus* the glands are single, with a median depression towards the point. In the small form it appears that the two glands are always of different size (Pl. XVI. Figs. 3, 19, to compare with Pl. XVI Fig. 15, representing a globiferous pedicellaria of *Sterechinus Agassizii*). — It is to be remarked that quite young specimens have only the small form of globiferous pedicellariæ, typically developed; the larger form appears at a size of ca. 5 mm. — A curious case of abnormality was observed in this species, viz. a triphyllous pedicellaria with two heads (Pl. XVI. Fig. 10).

The sphæridiæ form a not very close series, reaching to the 10th—11th ambulacral plate; in the larger specimens I count ca. 20 in a series. They are oval, smooth.

This species was taken by the Swedish South Polar Expedition on the following stations:

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* In one of my preparations I find some small globiferous pedicellariæ with the valves quite differently shaped, being very much like those of *Protocentrotus annulatus* (as figured in the Echinoidea of the German Southpolar Exped. Pl. XVI Fig. 5) with the blade quite open and with one tooth on either side. Having observed this, I carefully reexamined the specimens but was unable to find more than the usual small form. Accordingly I do not venture to state that these pedicellariæ really occur in *magellanicus;* on the other hand I do not see, how they could have come there, if they do not belong to this species. — They are distinctly different from those of *Loxech. albus*, the only species with globiferous pedicellariæ of the *Parechinus*-type found along with *magellanicus*. — The question cannot be decided, but I have thought it right to mention the matter.

Stat. 2 (37° 50′ S. 56° 11′ W. 100 m.; Coast of North Argentina); several specimens.
» 3 (54° 43′ S. 64° 8′ W. 36 m.; Tierra del Fuego); several specimens.
» 5 (64° 20′ S. 56° 38′ W. 150 m.; Graham Region, S.E. of Seymour Isl.). 1 specimen.
» 13 (54° 50′ S. 68° 16′ W.; shallow water; Tierra del Fuego); several small specimens.
» 14 (54° 49′ S. 68° 17′ W.; shallow water; Tierra del Fuego); 1 small specimen.
» 44 (51° 32′ S. 58° 10′ W.; just outside the Macrocystis zone; Falkland Isl.); 6 large specimens.
» 55 (52° 11′ S. 60° 26′ W. 40 m. Falkland Isl., Port Albemarle); 1 specimen.
» 58 (52° 29′ S. 60° 36′ W. 197 m. S. of West Falkland); 1 specimen.
» 59 (53° 45′ S. 61° 10′ W. 137—150 m. Burdwood Bank); 1 specimen.
» 60 (55° 10′ S. 66° 15′ W. 100 m.; East end of Beagle Channel); 1 specimen.

Further there is a considerable number of specimens from the Swedish Expedition to Tierra del Fuego, 1895—96, viz. from the localities Puerto Madryn, Punta Arenas, Hope Harbour, Puerto Churruca, Isthmus Bay, Fortescue Bay, Borja Bay, Isla Nueva & Navarino, Quarenta Dias Katamish niaia, Puerto Angosto, Ultima Esperanza, from low water mark to 30 fathoms.

The bottom on the different localities named above is mostly hard bottom with algæ.

The geographical distribution of the species, as far as known, is: the South American coast, up to the mouth of the La Plata on the Atlantic side, and to Ancon, Peru, on the Pacific side[1]; the Falkland Islands, Gough Island, the Kerguelen group, New Amsterdam. The other localities given in the »Challenger» Echinoidea p. 214, viz. Cape of Good Hope, Australia and New Zealand, are incorrect, relying upon incorrect determinations (cf. »Ingolf» Echinoidea I. p. 104; DÖDERLEIN, Echinoidea d. deutschen Tiefsee-Expedition, p. 227).[2]

The bathymetrical distribution is from shallow water down to ca. 300 m.; but it is, evidently, essentially a shallow water species, and the records of its occurrence in depths greater than ca. 300 m. might deserve a renewed careful examination, viz. the »Challenger» Stations 145, Prince Edwards Island, 310—315 fathoms and 147 — 1600 fathoms; especially the latter seems very improbable. (The depth 590 m. given in the Echinoidea of the German South Polar Expedition p. 105 rests on the »Challenger» station 145.)

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[1] RATHBUN, Catal. of Echini in the U. S. Nat. Museum. Proc. U. S. Nat. Mus. 1886 p. 278.

[2] I have not succeeded in finding any evidence for the locality Cape of Good Hope given in the place cited in the »Challenger» Echinoidea.

After the above was printed I received from Professor BENHAM, Otago, a specimen labelled *Echinus angulosus* from Stewart Island. It proved to have nothing with *Protocentrotus angulosus* (Leske) to do, but evidently belongs to the genus *Notechinns*, representing a new species, which I cannot, however, describe after the insufficient material in hand. It thus becomes probable that some of the statements of the occurrence at New Zealand of *Notechinus magellanicus* are based upon this species. The occurrence at New Zealand of a species of *Notechinus*, allied to the Patagonian *N. magellanicus*, is a fact of considerable interest from a zoogeographical point of view.

The specimens from Stat. 2 (off the La Plata) correspond to the var. *Hassleri* of DÖDERLEIN in being somewhat lighter in colour than the typical form. The spines are a little longer than is generally the case in the typical specimens, but, as seen from the measurements, they may be quite as long in the typical form. Regarding the number of the coronal plates, which is mentioned by DÖDERLEIN as the most important character, the variety having somewhat fewer plates than the typical form, the enumerations given above show that in these specimens at least, there is no such constant difference. On the other hand I find the test in these specimens generally distinctly pentagonal, whereas in the typical form it is generally quite round. Upon the whole I think it scarcely possible to maintain this form as a distinct variety; it is probably only a slightly modified deep-water form. (The station 2 is near the locality of type specimens of the Var. *Hassleri.*)

As will be remarked from the list of synonyms given under this species, I think it not improbable that *Notech. magellanicus* is really the same species as the *Echinus margaritaceus* LAMK. figured by VALENCIENNES in the Atlas of the »Venus» (Zoophytes Pl. 6. Fig. 1). Since, however, this can no longer be determined with certainty, the specimen having been lost, the name *magellanicus* will have to be kept. As for the species called *margaritaceus* by AGASSIZ and DÖDERLEIN, it is certainly not identical with LAMARCK's species, but this is treated more fully under *Sterechinus Agassizii* (p. 43).

It is with full right that DÖDERLEIN has removed this species from the genus *Sterechinus*, to which genus I had referred it in the Ingolf Echinoidea I. Undoubtedly the genus *Sterechinus* thus becomes much more natural and well limited. That *magellanicus* agrees in several respects with *Pseudechinus albocinctus* I had perfectly realized (Op. cit. p. 106), but especially DE LORIOL emphasizes the correspondence between these two species. It must be agreed that one might indeed be tempted to refer them to one and the same genus. After all I must, however, join DÖDERLEIN in making *magellanicus* the type of a separate genus, mainly on account of the globiferous pedicellariæ, which have in *albocinctus* only one lateral tooth, as in the family Echinometridæ. Besides, the curved actinal spines and the two kinds of globiferous pedicellariæ in *magellanicus* are rather conspicuous differences from *albocinctus* (I have been unable to find more than one form of globiferous pedicellariæ in *albocinctus*, having carefully examined the several specimens at my disposal); on the other hand, the fact that in *albocinctus* the globiferous pedicellariæ have double glands as in *magellanicus* is noteworthy. It seems, indeed, that the two species: *magellanicus* and *albocinctus* show the way from the Echinidæ to the Echinometridæ. — In case it be ultimately proved that these two species cannot be referred to different genera — or even different families — *magellanicus* must be referred to the genus *Pseudechinus*, to which *Notechinus* will then be a synonym.

Sterechinus Neumayeri (Meissner).

Pl. VI. Figs. 7—8. Pl. VII. Figs. 1—2, 4.

Sterechinus Neumayeri. Th. Mortensen. 1909. Echinoiden der deutschen Südpolar-Expedition p. 64.
— — R. Koehler. 1908. Astéries, Ophiures et Échinides de l'Expédition antarctique nationale Écossaise. Trans. R. Soc. Edinb. XLVI p. 616. Pl. XVI, 143—144.

This species has been carefully treated in my work on the Echinoidea of the German South Polar Expedition, the material from the present Expedition being also taken into consideration there, in order to avoid unnecessary splitting up of the description into two parts. Only the figures from the material of the Swedish Expedition are preserved for this work; for the description reference must be made to the work quoted, in which also the whole literature on this subject is recorded.

The species was taken at the following stations:

Station 5 (64° 20′ S. 56° 38′ W., Graham Region, S. E. of Seymour Isl. 150 m.). Several specimens.
» 8 (64° 3′ S. 56° 37′ W., Graham Region. 360 m.?). 1 specimen.
» 20 (54° 12′ S. 36° 50′ W., South Georgia. 250 »). 1 »
» 22 (54° 17′ S. 36° 28′ W., » » 75 »). 1 »
» 25 (54° 22′ S. 36° 27′ W., » » 24—52 »). 6 »
» 26 (54° 22′ S. 36° 27′ W., » » 30 »). 1 »

The bottom on these different stations varies considerably, from stony bottom covered with algæ to sandy or even clayey bottom.

Sterechinus Agassizii nom. nov.

Pl. VI Figs. 9—12. Pl. VII Fig. 3. Pl. XVI Figs. 1, 7—8, 13, 15, 18.

Echinus margaritaceus. A. Agassiz. 1872. Revision of Echini p. 124, 493.
— — — 1874. Zoological Results of the Hassler Expedition. Echini (Illustr. Cat. Mus. Comp. Zool. No. VIII) p. 11. Pl. II Fig. 6.
— — M. Meissner. 1900. Echinoiden d. Hamburger Magalh. Sammelreise p. 11.
Sterechinus — Th. Mortensen. 1903. »Ingolf» Echinoidea. I. p. 177—178. Note.
Echinus — De Loriol. 1904. Notes pour servir à l'étude des Échinodermes. 2 Ser. II. p. 16.
Sterechinus — L. Döderlein. 1907. Echinoiden d. deutschen Tiefsee-Expedition p. 219, 224. Taf. XXIX, Fig. 1. Taf. XXXV, Fig. 12. Taf. XLVII, Fig. 9.
— — R. Koehler. 1908. Astéries, Ophiures et Échinides de l'Expédition antarctique nationale écossaise. Trans. R. Soc. Edinb. XLVI p. 617.
? *Echinus* — F. Jeffr. Bell. 1902. Echinoderma. Southern Cross p. 219.
? — — — 1908. Echinoderma p. 6. National Antarctic Expedition. Natural History. IV. Zoology.
Non: *Echinus margaritaceus.* Lamarck. 1816. Animaux sans vertèbres. III. p. 47.
— — Blainville. 1825. Dictionnaire des Sciences naturelles. Vol. 37 p. 78.
— — Valenciennes. 1846. Voyage de la Frégate Vénus. Zoophytes. Pl. VI.

Non; *Echinus margaritaceus.* A. AGASSIZ. 1875. Zoological Results of the Hassler Exped. Echini. Pl. III. Fig. 4 (= *Notechinus magellanicus*).
— — — 1881. »Challenger» Echinoidea I. p. 117 (= *Sterechinus diadema*, pro parte).
Sterechinus — TH. MORTENSEN. 1903. »Ingolf» Echinoidea I. p. 101—2 (= *Sterechinus diadema*).
Echinus — R. KOEHLER. Expédition antarctique Française 1903—5. Stellérides, Ophiures et Échinides p. 30. Pl. I. 9. III. 29—30. IV. 40, 43 (= *Sterechinus Neumayeri*).

In the »Ingolf» Echinoidea I, p. 101—2 I described, under the name of *Sterechinus margaritaceus* (LAMK.), a species which was really *Sterechinus diadema* (STUDER). The description was based mainly on material from the »Challenger» Expedition, identified by Professor AGASSIZ as *Echinus margaritaceus* LAMK.; attention was called to several important features of the species, hitherto unnoticed. DE LORIOL having called my attention to the fact that in the figure of *Echinus margaritaceus* in the Atlas of the »Voyage de la Frégate Vénus», Zoophytes Pl. VI. 1, all the ocular plates are excluded from the periproct, by which fact alone it is shown beyond question that the species mentioned by me under the name *margaritaceus* could not really be identical with LAMARCK's (VALENCIENNES) *margaritaceus*, I suggested in the Appendix to Part I. (p. 177) that the *Echinus margaritaceus* LAMK. represented in the Atlas of the »Venus» might be really the same as *Ech. magellanicus*, because the figure mentioned represents the species as having a primary tubercle on all the ambulacral plates, like *magellanicus*, whereas in the species called *margaritaceus* by the later authors there is a primary tubercle only on every second ambulacral plate. This has been misunderstood by both KOEHLER, DE LORIOL and DÖDERLEIN, as if I regarded the *Echinus margaritaceus* AUCT. as the same species as *magellanicus*, and grave objections are raised against the view. This has, however, assuredly never been my meaning; on the contrary, I find it quite correct that *magellanicus* has been made the type of a separate genus.

I must here give my reasons, why LAMARCK's *Echinus margaritaceus* cannot be the same as the species described under this name by AGASSIZ in the »Revision of Echini» and the »Hassler»-Echini. LAMARCK's diagnosis: »hemisphærico-depressus, assulatus, ruber, verrucis albis eleganter ornatus; arearum majorum verrucis transversim fasciatis» is certainly most unsatisfactory; but it contains, at least, one word which decidedly does not suit with the species represented by AGASSIZ, viz. »*ruber*». AGASSIZ' species is white; and even if it is perhaps red in the living state, this does not matter. LAMARCK's specimen was a dried, naked test — but AGASSIZ' species will never be found red when dried and denuded. Also the expression »areorum majorum verrucis transversis fasciatis» does not suit with AGASSIZ' species. — BLAINVILLE (loc. cit.) has given the following description of *Echinus margaritaceus* LAMK.: »Têt hémisphérique, déprimé; quatre rangs de tubercules dont les extrêmes sont les plus gros sur les ambulacraires; dix rangs, dont le médian de chaque côté plus gros sur les anambulacraires; les séries des plus gros tubercules convergentes vers l'ouverture inférieure; épines et auricules? Couleur de chair avec les tubercules verts.»

»Cette espèce qui existe dans la collection du Muséum vient peut-être des mers australes, suivant M. de Lamarck.»

It is perfectly clear from this description that this species cannot be identical with the *margaritaceus* of AGASSIZ; the tuberculation is decidedly different, as is also the colour. And the last remark proves beyond doubt that BLAINVILLE has seen the type specimen, from which he evidently has made the description. In fact this description much more recalls a form like *Sphærechinus granularis.* The fact that the species is placed in the genus *Heliocidaris* in AGASSIZ & DESOR's »Catalogue raisonné» is also very much against A. AGASSIZ' interpretation of the species. The type specimen having been lost, it is impossible now to determine with certainty which species LAMARCK's *Echinus margaritaceus* was; it can only be said with certainty that it was *not* the species which A. AGASSIZ described under that name. The figures given by VALENCIENNES in the Atlas of the »Venus« do not help us to more certainty, the specimen having likewise been lost *; but they likewise show with certainty that it is *not* the species called *margaritaceus* by AGASSIZ; especially the fact that there is a primary tubercle on every ambulacral plate is important, the species called *margaritaceus* by AGASSIZ having a primary tubercle only on every second or third ambulacral plate. DÖDERLEIN (Op. cit. p. 218) does not think it right to trust the correctness of VALENCIENNES' figures in such details: »Ich glaube nicht, dass man aus der sehr schematischen Figur von Valenciennes mit Sicherheit einen Schluss ziehen darf, ob im Ambulacralfeld jede einzelne oder jede zweite Platte eine Primärwarze trug; mit dieser Annahme hat wohl Mortensen die Genauigkeit der farbigen Figur überschätzt.» I must object to this that it is not the coloured figure from which I conclude that VALENCIENNES' *Ech. margaritaceus* has a primary tubercle on all the ambulacral plates, but from the detail-figures 1. b. and 1. c., which are not at all schematic, but evidently as exact and careful as any of the best figures of details of the test structure of Echini since published. In the detail figures of »*Echinus pileolus*» (Pl. 9) it is very exactly shown that only every second ambulacral plate has a primary tubercle; there is then no reason to suppose that in the case of *Echinus margaritaceus* the figure should be so very incorrect, as it would be if it represented the species called *margaritaceus* by AGASSIZ.

In short: we cannot any longer with certainty unravel which species was really meant with LAMARCK's *Echinus margaritaceus;* but it is certain, from the descriptions given by both LAMARCK and BLAINVILLE, that it was not the species called thus by AGASSIZ. The figures given by VALENCIENNES equally speak decidedly against the identity with AGASSIZ' species (whether they really represent LAMARCK's species or another species (*magellanicus?*)). The result is then unquestionably that the species described and figured by AGASSIZ cannot rightly keep the name *margaritaceus;* I propose to name it *Sterechinus Agassizii.*

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* Even if this specimen were preserved, it would still be very questionable, whether it was really identical with LAMARCK's *Ech. margaritaceus;* the tuberculation is not at all in accordance with LAMARCK's species, as described especially by BLAINVILLE.

In »Stellérides, Ophiures et Échinides» de l'Expédit. antarctique Française» KOEHLER, after reproaching me for the confusion which I have raised in this case in my »Ingolf» Echinoidea, describes as »*Echinus margaritaceus*» a species which is quite different from both the »*margaritaceus*» of AGASSIZ and from the species which I had taken to be this species (viz. *Sterech. diadema*). It is *Sterechinus Neumayeri*, as is stated by Prof. KOEHLER in his later work on the »Astéries, Ophiures et Échinides de l'Expédition antarct. nationale Écossaise» p. 616. (I have myself had occasion to examine a pair of these specimens, kindly sent to me from Prof. KOEHLER.) At length all these species, »*margaritaceus*», *diadema*, *antarcticus*, *Neumayeri* and *horridus*, were diagnosed and redescribed by DÖDERLEIN (Op. cit.), to whom thus belongs the merit of having first cleared up this rather difficult case.

The reasons for the erroneous determinations by myself and Prof. KOEHLER are, partly the scarcity of the material at disposal, partly the insufficient descriptions given in the »Revision of Echini» and in the »Hassler» Echini; scarcely other characters are pointed out than such as distinguish the whole genus *Sterechinus.* The only figure given, Pl. II. b of the »Hassler» Echini, is likewise quite insufficient for distinguishing this species from *diadema* and *Neumayeri;* in fact, KOEHLER takes this figure as a proof of his species (*Neumayeri*) being the true »*margaritaceus*», as I have taken it as a proof that my species (*diadema*) was that species. DÖDERLEIN finds in this figure that all the ocular plates are excluded from the anal area (he wrongly writes »Apicalfeld», p. 218). I wonder how it is possible to see that on this figure; I am quite unable to distinguish more than three of the ocular plates, and these probably are excluded from the periproct, as also KOEHLER remarks (Expéd. antarct. Franc. p. 33). — (On the other hand, I find this figure, as also Pl. III. figs. 4 and 5, to be inverted; this is indicated by the fact that the anal opening is here represented as lying to the left side, while, as is well known, it really lies to the right (off Ocular I), the animal being orientated after LOVÉN's plan.)

In order to acquire full certainty of the identity of the specimens in hand with the species figured by AGASSIZ I sent one of the specimens to Professor H. LYMAN CLARK asking him to do me the favour to compare it directly with the specimen figured in the »Hassler» Echini. He kindly informed me that he found it to be the same species. I also sent one specimen to Professor DÖDERLEIN, asking him to give me his opinion, whether it was really the same species as that described by him as *Sterech. margaritaceus*, pointing out for him certain minor differences between the two forms. Prof. DÖDERLEIN kindly told me that, in spite of these differences, it was certainly identical with the species described by him. Thus, through the direct comparison with the specimen from the »Hassler» as well as with those described by DÖDERLEIN, it is made evident that the specimens before me really belong to the species called *margaritaceus* by these authors.

DÖDERLEIN points out (Op. cit. p. 219) the following main characters as distinguishing this species from the other species of the genus *Sterechinus:* The height of the test is lower than half the horizontal diameter; all the ocular plates are constantly excluded from the anal area; the blade of the globiferous pedicellariæ is almost quite open. — The rather considerable material of the species procured by the Swedish Southpolar Expedition, however, necessitates some modifications of these characters of the species.

As shown by the following measurements of the specimens in hand, the height of the test is, in the larger specimens, generally lower than half the diameter; in one specimen, however, of 54 mm. diameter the height is 30 mm., thus not inconsiderably higher than half the diameter. Likewise in the small specimen of

Station.	Diameter.	Height.	Peristome.	Apical area.	Anal area.	Largest width of		Number of plates.		Ocular plates.	Longest spines.
						Ambulacra.	Interambulacra.	Ambulacra.	Interambulacra.		
	mm.	mm.	mm.	mm.	mm.	mm.	mm.				mm.
St. 16	60	25	13	12	7	12	23	38	19	I nearly in contact	ca. 20
»	60	26	14	13	6.5	12.5	23.5	38–39	20–21	I in contact	ca. 20
St. 20	58 *	26	15	13	8	13	22	33—34	18	I and V in wide contact	?
»	56	24	14	11.5	6	12	21.5	38—39	19	all excluded	?
»	54	25	13	11.5	6	12	22	37	19	all excl.	ca. 19
St. 59	54	**30**	15.5	11.5	6	12	20.5	35	18	all excl.	?
St. 16 (?)	52	23	13	10	5.2	12	20.5	35	18—19	all excl.	?
»	52	23	13	10.5	6	11.5	20.5	34	18	all excl.	ca. 21
» (?)	51.5	23	14	10.5	5.5	11	21	33	19	all excl.	?
»	39	16.5	9.5	8	4	9	15.5	31	16	all excl.	20
» (?)	31	15	9.5	7.2	4	7	11	26	14	all excl.	17
Falkland Islands	31	15.5	10.5	7	3.5	6.5	12	28	16	all excl.	?
St. 22	29	14	9.5	6.5	4	7	11	31	16	I in contact	?
» 59	11	6	5	3.5	2	3	4	17—18	11	all excl.	5

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* Probably a hybrid between *St. Agassizii* and *St. Neumayeri.*

11 mm. diameter (Stat. 59) the height is larger than half the diameter. But upon the whole it must be said that the height of the test is distinctly smaller than in *St. diadema*, the species to which it is nearest related, and from which it is not distinguished without some difficulty (comp. measurements of the latter species given in »Echinoiden der deutschen Südpolar-Expedition» p. 75).

The whole shape of the test differs from that of *diadema*, besides by the greater flatness, in being regularly round in outline, whereas in *diadema* it is somewhat pentagonal. The test is not flat on the abactinal side (as in *antarcticus*), but generally distinctly conical, somewhat more so than in *diadema*, in which latter it is somewhat more arched. — The edge of the actinostome is distinctly sunken, as pointed out by DÖDERLEIN, whereas it is almost flat in *diadema* (Pl. VI. Figs. 10—12).

The number of plates in the ambulacra and interambulacra is upon the whole as in *diadema*, as far as can be concluded from the comparatively small material of the latter species. There is, however, some variation in the number of plates; thus a specimen of 58 mm. diameter has 33—34 ambulacral and 18 interambulacral plates, whereas a specimen of 56 mm. diameter has 38—39 ambulacral and 19 interambulacral plates. As a general rule the number of ambulacral plates is about double of that of the interambulacral plates; only in the youngest specimen, 11 mm. diameter, there are only 17—18 ambulacral plates against 11 interambulacral. — The relative width of the areas is mainly the same in the two species; in the larger specimens the interambulacra are, at the ambitus, about twice as broad as the ambulacra, in younger specimens they are somewhat narrower.

To DÖDERLEIN's description of the tuberculation I have to add that the scrobicular areas in the interambulacra are in contact at and below the ambitus, almost to the peristome (Pl. VI Figs. 10, 12); in one specimen (Stat. 16, 60 mm. in diameter, otherwise quite a typical specimen) they are, however, not in contact, being separated even at the ambitus by a distinct series of miliary tubercles. In the ambulacra the scrobicular areas may join for a short space at the ambitus in the larger specimens. DÖDERLEIN states that the small tubercles, though partly larger on the actinal side, never form distinct series; this is also the case in some of the larger specimens before me (the smaller specimens must, of course, be left out of consideration here), but in most of the specimens the secondary tubercles form, in the interambulacra, distinct longitudinal series, both inside and outside the primary series. This is in so far a good distinguishing character, the secondary tubercles not forming longitudinal series on the actinal side in *diadema;* but, it must be conceded, it is no constant character of *Agassizii*. The small secondary tubercles at the ambitus may be more or less distinctly arranged in transverse series.

The apical system and the anal area are of the same size as in *diadema*, and the character of the anal area is the same: a small, but mostly distinct, central plate surrounded by numerous smaller plates. The character that the ocular plates are all excluded from the anal area is, unfortunately, not constant. Certainly it is generally the case, which then gives a good distinguishing character, but in some of the specimens in hand, which I am otherwise unable to distinguish from the typical form, one or even two ocular plates are in contact with the anal area, viz. in two specimens Ocular I, in one specimen (Stat. 20) Oculars I and V. The latter specimen, however, is probably a hybrid between *St. Agassizii* and *Neumayeri.* (The shape of its test is as in *Agassizii*, but the secondary tubercles on the actinal side are less prominent than is generally the case in *Agassizii*, and the central plate is quite indistinct as is the case in the larger specimens of *Neumayeri.* There are numerous spicules as in *Agassizii;* the globiferous pedicellariæ are of the form typical in *Agassizii.* — It may be noticed that *St. Neumayeri* is represented from the same station.) Of the two other specimens one is that mentioned above, in which the scrobicular areas are separated throughout the whole series (Stat. 16), the other is a small specimen, 29 mm. (Stat. 22). As there is evidently no reason for regarding these specimens as hybrids, it must be conceded that the character of all the ocular plates being excluded from the anal area is not quite constant; in most cases it is found, however. — Generally there are distinct genital papillæ, as in the other *Sterechinus*-species. The genital openings are present already in the youngest specimen, 11 mm. diameter. (A still younger specimen, 7 mm., has likewise the genital openings developed; the identification of this specimen is, however, not certain.)

The peristome is rather small, generally smaller than in *diadema.* The buccal plates usually carry one or two small spines.

The spines are like those of *diadema;* they are very fragile as in all the *Sterechinus*-species. The secondary spines are upon the whole slightly longer than those of *diadema;* they are slender and finely thorny as in that species, ending in a small central thorn or gradually tapering to a point; the latter case seems always to occur, where the point has been restored, which is very often the case (Pl. XVI. Figs. 7, 13). (The mark, from where the restored part begins, is very distinctly seen by microscopical examination.)

The globiferous pedicellariæ have generally the blade almost quite open, as stated by DÖDERLEIN; but sometimes there are crossbeams over the lower half of the blade, or even almost to the end of it — and both kinds may be found in the same specimen. The poison-glands are single, but with double efferent duct (Pl. XVI Fig. 15), as is also the case in the other *Sterechinus*-species, in marked contrast to *Notechinus*, where the glands are double. DÖDERLEIN describes the tridentate pedicellariæ as having almost parallel side-edges; this is, however, generally the case only in small specimens, whereas in larger ones the shape of the valves is that usually found in the *Sterechinus*-species (Pl. XVI. Fig. 1). They are, upon the whole, rather small and slender, reaching scarcely the size of 1 mm. length of head. The ophicephalous and triphyllous pedicellariæ show no specific characters. — The sphæridiæ continue to the 13th—14th ambulacral plates in larger specimens, ca. 35 in each series. They are elongate, oval, smooth (Pl. XVI. Fig. 18).

Spicules (Pl. XVI. Fig. 8) are rather numerous in the tubefeet; no spicules are found in the walls of the intestine, genital organs, axial organ or stone canal. The genital organs are not anastomosing.

The colour in alcohol is whitish. There are no indications of the colour of the living animal.

The species was taken by the Expedition at the following stations:

Station 16 (51° 40′ S. 57° 25′ W. 150 m. Between Falkland Isl. and South Georgia). 6 specimens.
» 17 (53° 34′ S. 43° 23′ W. 160 m. Shag Rocks Bank). 1 specimen; identification uncertain.
» 20 (54° 12′ S. 36° 50′ W. 250 m. South Georgia). 1 specimen, ? hybrid.
» 22 (54° 17′ S. 36° 28′ W. 75 m. » »). 1 »
» 59 (53° 45′ S. 61° 10′ W. 137—150 m. Burdwood Bank). 2 specimens.
Falkland Islands 1 specimen.
No locality (? Stat. 16) 3 specimens.

The geographical distribution of this species appears to be very restricted. It is known with certainty only from the Southern Extremity of South America, as far north as 49° 35′ S. on the Atlantic side, while there are no certain indications for the Pacific side; further it is known from the Falkland Islands and South Georgia, while its occurrence at Juan Fernandez is doubtful (»Hassler» Echini, p. 12). The bathymetrical distribution is ca. 75—250 m. DÖDERLEIN (Op. cit. p. 224) gives 29—447 m. as its bathymetrical range (rounded to 25—450 m. in my list in the Echinoidea of the German South Polar Expedition, p. 105). As for the statement of its occurrence at a depth of 447 m. it is based on the »Challenger» Echinoidea (p. 117); Professor AGASSIZ having, however, not distinguished sharply the *Sterechinus*-species (at least *St. diadema* has been confounded with the present species, probably also *St. Neumayeri*), this statement is not quite certain and had better be left out of consideration, until a renewed examination of the »Challenger»-specimens has been undertaken. The statement of its occurrence at so low a depth as 29 m. is due to M. MEISSNER, who in his »Echinoideen der Hamburger Magalhaensischen Sammelreise» 1900, p. 11, records the species from West Patagonia, Gulf of Peñas, 16 fms. Through the kindness of Dr. O. STEINHAUS I have received these specimens for examination and find them to be *Notechinus magellanicus* (whereas those from the two other localities named there are correctly identified). The bathymetrical distribution of this species is thus not known with certainty to exceed 75—250 m.

The statement of the occurrence of the species at Kerguelen and Heard Island (»Challenger» Echinoidea) is uncertain, being founded on incorrect determinations, partly at least, and must be left out of consideration until it has been definitely proved that this species is really found in the said material or is otherwise recorded from these regions. The occurrence of the species at New Zealand (Rev. of Echini, p. 124) is still more improbable. The statement is founded on specimens in the Smithsonian Institution. But there are no specimens from that locality there, at least now, only two specimens with »unknown locality», according to Professor RATHBUN's »Catalogue of the collection of Recent Echini in the U. S. National Museum» (Proc. U. S. Nat. Mus. 1886, p. 278), and Miss RATHBUN, who has kindly made a renewed research on this matter for me, gives me the same communication. Thus this evidence for the occurrence of the species at New Zealand is not worth much. The species is further named by Mr. H. FARQUHAR in his paper »On the Echinoderm Fauna of New Zealand» (Proc. Linn. Soc. N. S. Wales 1898, p. 320), but no new evidence of its occurrence there is given; in his later »Notes on new Zealand Echinoderms» (Trans. New Zealand Inst. XXXIX, 1906, p. 130) he says that, though it might be expected to occur there »it is not known to New Zealand naturalists (and) it may be omitted for the present». — A definite statement of its occurrence at New Zealand is given by FILHOL,* who reports to have dredged the species in considerable numbers in Cooks Strait and at Stewart Island; also at the Campbell Island some specimens were obtained. There is, however, scarcely any doubt that this statement rests on wrong identification; the fact that the species is stated to be common in Cook's Strait decidedly points towards a confusion with *Pseudechinus albocinctus*. It would be very desirable to have these specimens reexamined, those from New Zealand as well as those from the Campbell Island; the latter would perhaps give a valuable contribution towards the solution of the problem, whether the marine littoral fauna of the Campbell Island is more nearly related to that of New Zealand or that of the Antarctic Continent. (Cf. Die Echinoiden d. Deutschen Südpolar-Exped. p. 93). Unfortunately none of the specimens are in the collection of the Museum d'histoire naturelle in Paris, as I am informed by Professor JOUBIN, so the question must be left undecided. — Also from the littoral region of the Antarctic Continent »*Echinus margaritaceus*» is recorded, viz. by Prof. BELL in his papers on the Echinoderms of the »Southern Cross» (1902, p. 219) and of the »National Antarctic Expedition» (Natural History. IV. Zoology. Echinoderms, p. 6). As, however, in the first place the author himself expresses some doubt regarding the correctness of the identification, and in the latter paper the species *diadema*, *horridus* and *antarcticus* are given as synonymous, it is evident that these statements of the occurrence of the species in the Antarctic sea cannot be taken into account.

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* Recherches zoologiques, botaniques et géologiques faites à l'île Campbell et en Nouvelle Zélande. Zoologie. Chap. X. Échinodermes. Recueil de mémoires, rapports et documents relatifs à l'observation du passage de Venus sur le Soleil. III. (2). 1885. p. 572.

The fact that the species *St. Agassizii*, *diadema* and *antarcticus* appear to have only a very restricted distribution (*diadema* known only from the Kerguelen-region, *antarcticus* only from the coasts of the Antarctic Continent) would seem to indicate that these species have not pelagic larvæ, because in that case they would probably have a much wider distribution, as is the case with *St. Neumayeri*, which is known (through the researches of the German South Polar Expedition) to have pelagic larvæ. The size of the eggs in these species seems to point to the same conclusion, those of *St. Neumayeri* being distinctly smaller than those of the other three species. (Cf. Echinoiden d. Deutschen Südpolar-Exp. p. 96. Note.)

The genus *Sterechinus*, established by KOEHLER (Échinides et Ophiures du »Belgica», 1901, p. 8) for the species *antarcticus*, was extended by me in the »Ingolf» Echinoidea I (p. 106) to include also the species »*margaritaceus*» (including *diadema*), *horridus*, *Neumayeri* and *magellanicus*. DÖDERLEIN (Echinoiden d. deutschen Tiefsee-Exped. 1906, p. 217) again excluded *magellanicus*, making it the type of a separate genus, *Notechinus*, and thus gave the genus *Sterechinus* a much more uniform character. In »Stéllérides, Ophiures et Échinides» de l'Expédition Antarctique Française, 1906, p. 36—39, KOEHLER again maintains the genus in its original sense, including only the species *antarcticus*, but recently, in »Astéries, Ophiures et Échinides de l'Expédition antarctique nationale Écossaise», 1908, p. 618 he explains that he now fully adopts my view on this matter, as corrected by DÖDERLEIN. There is thus now full agreement on this point between all those authors, who have treated these species recently.

The fact that the distinguishing characters of the species within this genus are, upon the whole, of comparatively slight value, seems to indicate that the species have been comparatively recently differentiated, probably in connection with the geological transformations in these regions (subsidence of the former land or shallow-water connection between South America and the Kerguelen-group on one side and between South America and the Antarctic Continent on the other side). It may be suggested that before this subsidence they were represented by a single species distributed along the coasts of this whole extensive land. Through the subsidence the specimens inhabiting the intermediate regions were exterminated, leaving the rest inhabiting three isolated areas; in the course of the time elapsed since the epoch of the subsidence the three groups of specimens have been transformed into separate species; but it seems that the time has not been long enough for transforming them to any high degree. (Cf. Echinoiden d. deutschen Südpolar-Exped., the chapter on the geographical distribution of the antarctic and subantarctic Echinoids.)

Loxechinus albus (Mol.).

Pl. VI, Figs. 1—6. Pl. VIII. Pl. XVI, Figs. 2, 4—5, 14, 16—17.

Echinus albus Molina. 1782. Saggio sulla storia naturale del Chili, p. 200, 348. *
— *porosus* Valenciennes. 1846. Voyage de la Frégate »Vénus». Zoophytes. Pl. III, Fig. 2, 2 a. Pl. IV.
? — *erythrogrammus* Valenciennes. 1846. Voyage de la Frégate »Vénus». Zoophytes. Pl. VII.
— *albus* L. Agassiz & Desor. 1846. Catalogue rais. d. Échinides, p. 368.
Heliocidaris erythrogramma L. Agassiz & Desor. 1846. Catalogue rais. d. Échinides, p. 371.
Echinus albus Blanchard. 1854. In Gay, Historia fis. y pol. de Chile. Zoologia. VIII, p. 417.
Heliocidaris erythrogramma Blanchard. 1854. In Gay, Historia fis. y pol. de Chile. Zoologia. VIII, p. 420.
Loxechinus albus Desor. 1858. Synopsis des Échinides fossiles, p. 136.
— — Dujardin & Hupé. 1862. Hist. nat. des Zoophytes Échinodermes, p. 535.
Strongylocentrotus albus A. Agassiz. 1872. Revision of Ech., p. 162, 438.
— *gibbosus* A. Agassiz. 1881. »Challenger» Echinoidea, p. 106.
— *bullatus* F. Jeffr. Bell. 1881. Echinodermata. Account of the Zool. Coll. of H. M. S. »Alert» in the Straits of Magellan and on the Coast of Patagonia. IX. P. Z. S., p. 88. Pl. VIII 1—2.
— sp. inc. F. Jeffr. Bell. 1881. Ibidem, p. 89. Pl. VIII, Figs. 3—4.
— *albus* F. Jeffr. Bell. 1881. Observations on the Characters of the Echinoidea. IV. The Echinometridæ. P. Z. S., p. 415, 426.
— *bullatus* F. Jeffr. Bell. 1881. Ibidem, p. 415, 426.
— *albus* M. Meissner. 1896. Die von Herrn Dr. Plate aus Chile heimgebrachten Seeigel. Arch. f. Naturgesch. 62. I, p. 86.
— — M. Meissner. 1900. Echiniden. Hamburger Magalhaens. Sammelreise, p. 9.
— *bullatus* M. Meissner. 1900. Echiniden. Hamburger Magalhaens. Sammelreise, p. 8.
Loxechinus albus Th. Mortensen. 1903. »Ingolf» Echinoidea I, p. 122, 134. Pl. XVII, Figs. 5, 18.
— *bullatus* — — — — p. 134.
— *gibbosus* — — — — p. 134, 178. Pl. XVII, Fig. 12.

For some other literary references, giving only the names, I may refer to the works of Meissner quoted above.

In view of the great confusion which has reigned concerning this species it may not prove superfluous to give here a full description and figures, together with corrections of some previous indications.

The measurements given here represent specimens taken by the Swedish South Polar Expedition (at Station 3), excepting the largest specimen, which is an old, dried test, preserved in the Museum of Copenhagen (the specimen represented in Pl. VI, Figs. 3—4, 6).

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* In Revision of Echini p. 162 Agassiz quotes this reference under p. 175, which is from the French translation of Molina's work.

Diameter.	Height.	Peristome.	Apical area.	Anal area.	Width of			Number of plates.		Longest spines.
					Ambulacra.	Pore area.	Interambulacra.	Ambulacra.	Interambulacra.	
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.			mm.
98	50	25	17	10	26	7—7.5	33—34	37	23	
74	36	21	14.5	9.5	19	5.5	23.5	29	18	18
64	32	19.5	14	8.5	17	5.5	21.5	26	18	
42	21	13.5	9.5	6.	11	3.2	14.5	21—22	14	18.5

The test is regularly rounded, sometimes with a slight indication of being pentagonal; it is low, somewhat flattened above, the height only half the horizontal diameter; the actinal side nearly flat, the edge of the peristome scarcely incurved.

The ambulacra are rather broad, nearly as broad as the interambulacra, as seen from the measurements. The primary tubercles, which — as is the case in all polyporous forms — occur on all the compound plates, make two regular series, generally considerably smaller than those of the interambulacra. The interporiferous zone is comparatively narrow, in consequence of which the larger secondary tubercles inside the primaries form only a single median series on the actinal side (Pl. VI Fig. 2); above the ambitus, where the plates are wider, these tubercles are arranged so as to form two alternate series. This is, however, not always the case. In the largest specimen in hand, as well as in another specimen of 73 mm. they are arranged in distinct double series, except at the upper and lower end. In the smallest specimen in hand (the one of 42 mm. in the above measurements) they form only a single series in the whole ambulacrum. This larger secondary tubercle is placed in the inner corner of the ambulacral plate, opposite to or a little higher than the primary tubercle. The rest of the plate inside the primary tubercle is covered by more or less numerous miliary tubercles, one at the upper edge, almost midway between the median line and the innermost pore, being slightly larger than the others. The pore areas are rather broad; the pores, generally 7—9 in each series, are arranged, on the actinal side, in nearly horizontal rows, slightly S-shaped. Above the ambitus the arcs are more erect, the outer 3—5 pores (sometimes even 6) forming a straight vertical series close to the outer edge, the remaining 2—4 upper pores alone being so placed as to form a curve towards the middle line of the area. The 2—3 pore-arcs nearest the peristome have only 3 pairs of pores; the third—fourth has four pairs, the 5th—6th five pairs etc. The arcs of pores are separated by oblique rows of 3—4 secondary tubercles. On the actinal side there is only one such row of tubercles between each two pore-arcs, while on the abactinal side there are some smaller tubercles above this row, more or less distinctly serially arranged, so that here may be two distinct series of tubercles between each two arcs of pores, the lower series remaining the largest. These tubercles may vary somewhat in size, but generally they are nearly so large as the inner secondary tubercle, and the oblique rows formed by them make a prominent feature of the species. — The pore-areas are scarcely narrowing towards the peristome, the ambulacra being here distinctly wider than the interambulacra.

The primary interambulacral tubercles form a pair of prominent vertical series; mostly they are considerably larger than the primary ambulacral tubercles, but sometimes they are not much larger than the latter; they scarcely diminish in size towards the apical system, whereas they diminish considerably in size towards the peristome. The secondary tubercles are not very prominent. Only in the largest specimen they are almost as large as the primary ones, forming at and just below the ambitus a distinct, regular vertical row inside and a more irregular vertical row outside the primary series (Pl. VI. Fig. 6). In the other specimens they are considerably smaller than the primary tubercles. Each plate (at the ambitus) carries generally two larger secondary tubercles inside the primary tubercle off the upper edge of the latter, the median one being the larger, and a corresponding pair outside the primary tubercle, the outer one generally being the larger. There is thus an indication of an arrangement in horizontal rows of these tubercles, while the larger inner tubercles form more or less distinct longitudinal series. — In the specimen figured in Pl. VI. Figs. 1—2, 5 the secondary tubercles are perhaps somewhat exceptionally small. The rest of the plates is closely covered by miliary tubercles, no naked median space being left.

The apical system is held by BELL to be especially characteristic in having all the ocular plates excluded from the periproct. This seems also to be the general rule, but it is no constant character. Among the specimens examined by me, 11 in all, 3 specimens (among which the smallest) have 2 ocular plates in contact with the periproct viz. plates I and V in two specimens, IV and V in one. According to BELL (Observations on the characters of the Echinoidea. IV. The Echinometridæ. Proc. Zool. Soc. 1881, p. 429) even 4 ocular plates may be in contact. The genital plates have mostly a rather prominent series of tubercles along their inner edge. Sometimes two pores are found in one genital plate. The madreporic plate is very large, especially in the larger specimens. The anal opening is nearly central. The anal plates are rather large, carrying tubercles; there is no distinct central plate.

The buccal membrane contains only few small plates outside the buccal plates, most of them rather thick, carrying a few triphyllous, sometimes also some ophicephalous pedicellariæ. Numerous small plates are found inside the buccal plates; the latter carry rather numerous pedicellariæ, ophicephalous and triphyllous, but no spines.

The spines are upon the whole short and coarse; but the primary spines are generally considerably longer and stouter than the secondary ones, thus being very prominent, though short in comparison with the diameter of the test (Pl. VIII). They are somewhat tapering, but not pointed; they are finely striated longitudinally, otherwise smooth. The same also holds good for the smaller spines. The colour of the spines is olive green, sometimes with a brownish tint. According to AGASSIZ (Rev. of Ech. p. 439) they are tipped with white; this is, however, not the case in the specimens at my disposal.

Spicules are extremely scarce in the tubefeet, only very seldom a single one of the usual bihamate type occurring below the sucking disk. The walls of the intestine likewise are devoid of spicules, whereas the genital organs contain rather numerous fine, bihamate spicules. Also the gills contain some few bihamate spicules, mainly in the outer branchlets, while in their lower part the usual fenestrate plates occur.

The pedicellariæ have been carefully described and figured in the »Ingolf» Echinoidea I, p. 122. Pl. XVII. Figs. 5, 12 and 18, to which work I may refer. I shall here only give a few supplementary figures and remarks. The globiferous pedicellariæ (Pl. XVI Fig. 17) are characteristic in having a distinct neck, in which only longitudinal muscles are found. The valves are as figured in the »Ingolf» Echinoidea. I. Pl. XVII. Fig. 5, though sometimes more irregular; the upper end of the apophysis may sometimes reach nearly to the edge. The tridentate pedicellariæ (Pl. XVI. Figs. 2, 5) are generally as here represented; the two figures given in the »Ingolf» Echinoidea I. Pl. XVII. Figs. 12 and 18 represent the extreme forms, the former the small and less differentiated, the latter the largest and most differentiated form. In those figured here the serrations at the end of the blade are much less tooth-like than in the Fig. 18 of the »Ingolf» Ech., and there is no distinct keel in the middle of the blade. The ophicephalous pedicellariæ (Pl. XVI. Fig. 14) have rather lengthened valves with the apophysis widened over the blade, not forming a keel. The triphyllous pedicellariæ (Pl. XVI. Fig. 16) are small, with the blade rounded, the edge not serrated.

The sphæridiæ (Pl. XVI. Fig. 4) are of the usual elongate oval shape, finely thorny. They are not very numerous, only about 20 being counted in each series in the larger specimens; they continue until ca. the 10th ambulacral plate.

The test is beautifully coloured: the median part of the ambulacra and interambulacra, between the two series of primary tubercles, is of a prominent reddish-violet colour, on the whole abactinal side, the colour gradually disappearing on the actinal side, though it may sometimes be traced almost to the actinostome. The tubercles are white. The pore areas are of a light greenish colour, the outer edge of the interambulacra of a darker green colour. The apical plates are of the same red colour as the median part of the ambulacra and interambulacra.

The species was taken by the Swedish South Polar Expedition at Station 3 (54° 43′ S. 64° 8′ W. 36 m.), 4 specimens. Further the Swedish Fuegian Expedition, 1896, has taken 1 specimen in Stewart Harbour, 20 fms., 2 specimens in Fortescue Bay, 10—12 fms., on bottom with algæ.

The geographical distribution of the species is the Pacific Coast of South America, from Tierra del Fuego to Callao (and probably still farther north). On the Atlantic Coast it is not known beyond the Magellan Strait. — From other localities it has only been recorded from the Philippines, with doubt, in »Revision of Echini» p. 162, while in the »Challenger» Echinoidea p. 211 this locality is given without reservation. That the species does not really occur at the Philippines can not be doubted.

The bathymetrical distribution appears to be very limited, as it is not known from greater depths than 85 m. (»Challenger» Ech. St. 304 »*Strongylocentrotus gibbosus*»). It is thus evidently a strictly littoral species.

The history of this species is rather intricate. Abbé MOLINA in his »Essai sur l'histoire naturelle du Chili» (translated from Italian by M. Gruvel 1789 *) gives a very poor description of his two species, *Echinus albus* and *niger* (p. 175): »Dans le genre des oursins il faut d'abord distinguer les oursins blancs et les noirs. Les blancs (Echinus albus) sont de forme globuleuse, et d'environ trois pouces de diamètre, le têt et les piquants sont blancs; la substance intérieure, qui est d'un gout excellent, est jaunâtre. Les oursins noirs (Echinus niger) sont de forme ovale, un peu plus grands que les blancs, ils ont le têt, les piquants et les œufs noirs, et on ne les mange pas.» In a note the following diagnoses are given. *Ech. albus:* »Echinus hemisphærico-globosus, ambulacris denis; areis longitudinaliter verrucosis». *Ech. niger:* »Echinus ovatus, ambulacris quinis, areis muricatis verrucosis». It might, indeed, seem quite impossible to recognize from this description the two species now identified as MOLINA's *Echinus albus* and *niger*, viz. *Loxechinus albus* and *Tetrapygus niger;* especially the former has neither the test nor the spines white, as said by MOLINA. Nevertheless it does not appear that MOLINA's description could be better applied to any other Echinoid commonly occurring at the coasts of Chili, so it seems that the interpretation first given in the »Catalogue raisonnée des Échinides» by AGASSIZ & DESOR is correct. The correctness of this identification is also indicated by the description of *Echinus albus* given (by BLANCHARD) in GAY's Historia fisica y politica de Chile (loc. cit.): »E. hemisphærico depresso, obscure pentagono, viridescente, spinis albescentibus; ambulacra decem bifariam poribus instructa; tuberculis minimis; spinis tenuibus et brevibus».[1]

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* The Italian Original work »Saggio sulla storia naturali del Chili» 1782, I have not seen; but Dr HARTMEYER in Berlin has kindly quoted the place for me, so that I have been able to compare it with the translation.

In the Atlas of the »Voyage de la Frégate Venus», Zoophytes Pl. 4, VALENCIENNES gives an excellent, coloured representation of the species, naming it *Echinus porosus*.[2] That this is really the species now called *Loxechinus albus* cannot be doubted (how L. ARASSIZ & DESOR could recognize it as MOLINA's *Echinus albus* is not so apparent). In the same work is figured another species, *Echinus erythrogrammus* (Pl. 7. 1.). On comparing a denuded younger specimen of *L. albus* with the quoted figures of »*Ech. erythrogrammus*» one must be struck with the close resemblance with that species, and seeing further that the *Ech. erythrogrammus* is marked as being from Chili, one cannot help thinking that it is really the same as *Loxech. albus*, not the Australian species identified as *Strongylocentrotus erythrogrammus* by A. AGASSIZ in the »Revision of Echini». Wishing to have this question settled I wrote to Professor JOUBIN, the director of the Museum d'histoire naturelle of Paris, asking if he could possibly lend me the type specimen for direct comparison with *L. albus*. With the greatest liberality, for which I cannot thank him enough, he granted my request.

There are two specimens, belonging to two quite different species. One is *Toxocidaris gibbosus* (VAL.); it is marked »Chili, M. Gay». The other, which is evidently the specimen figured in the »Vénus», and which must be regarded as the type of the species *erythrogrammus*, has no locality — it is only marked »Mrs. Hombron et Jacquinot 1841». According to a communication from Prof. JOUBIN these two gentlemen were the naturalists of the Expedition of »L'Astrolabe» and »La Zélée», 1837—40. This expedition visited both South America and Australia (Tasmania). The specimen may thus have come from either of these coasts. The locality »Chili» given in the Atlas of the »Vénus» cannot be relied upon, as it may probably have been taken from the other specimen. We cannot therefore conclude from the locality of the specimen, whether the name *erythrogrammus* ought to belong to the South American species or to the Australian species with which it was associated by A. AGASSIZ. — A close examination of the figures in the »Vénus» shows that there must have been made another mistake. It is easily seen that the detailed figure of the actinal side, 1. b., cannot — if it is not very badly drawn which does not at all appear to be the case — possibly belong to the same species as that figured in 1. a, representing part of the abactinal side. The pore-arcs prove this beyond doubt: the figure 1. b. shows the rather irregular arcs to have 4 (? 3 or even 2) pairs of pores only, the pore areas narrowing considerably towards the ambitus; the figure of the abactinal side, 1. a., shows the arcs consisting of 8 pairs of pores close to the ambitus. A comparison with the original specimens shows that the figure of the abactinal side agrees closely with the specimen of HOMBRON and JAQUINOT, whereas the other figure is quite different from either of the two specimens. This figure must then be left out of consideration as quite erroneous, belonging really to quite a different species — I cannot tell which — and only by a mistake put in here as representing the species *erythrogrammus*.

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[1] The work is not found in the libraries of Copenhagen; the above quotation I owe to Dr. R. HARTMEYER at the Berlin Museum, who kindly copied for me the quotations wanted. The same was the case with MOLINA's »Saggio sulla storia naturali del Chile» of which only translations are found in the Copenhagen libraries.

[2] The type specimen is not in the collection of the Museum d'hist. naturelle in Paris, as Professor JOUBIN has kindly informed me.

Regarding now the type specimen of *erythrogrammus*, it really shows a very considerable resemblance to *L. albus*. The shape of the test, apical system, pores, tuberculation, colour (now very much faded, though showing evident traces of the original colour) are quite the same. The secondary ambulacral tubercles are arranged in two distinct vertical series, as is also the case in some specimens of *albus* (not in all specimens, cf. the above description, p. 53).

A comparison with the Australian species commonly called »*Strongylocentrotus*» (*Toxocidaris*) *erythrogrammus*, gives the result that only one feature seems against that identification, viz. that in the Australian species two ocular plates are broadly in contact with the anal system (as is also seen in the Pl. V. a. Fig. 4 of »Revision of Echini»), whereas in the type specimen no ocular plate is in contact with the periproct. Nevertheless, since the South American species is rather variable in regard to the ocular plates, there may also be some variation in this point in the Australian species — though I have seen no cases of the ocular pores being shut out from the periproct in that species, and I do not know that such cases have been mentioned in literature.

The result is then, that it is most probable that the type specimen of *Echinus erythrogrammus* is identical with *Loxechinus albus*, but it cannot be said with full certainty. If there had only been a single globiferous pedicellaria left on the type specimen, it would have been easy to decide the question. Under these circumstances, however, it appears to me that we are not fully justified in making the name *erythrogrammus* a synonym of *L. albus*, and thus we may keep it for the Australian species, so that no change of name for that species will be needed. — In »Revision of Echini» AGASSIZ gives the *Echinus erythrogrammus* (pars) as synonym of »*Str.*» *albus*, besides as the type of his *Strongylocentrotus erythrogrammus* (p. 162—163). He has thus observed either that the figures or that the original specimens represent two different species; but the reference is not correct, as one of the specimens is decidedly *Toxocidaris gibbosus*, the other either *Loxechinus albus* or *Toxocidaris erythrogrammus*, not both of them.

In 1881 Prof. BELL described, in his Report on the Echinoderms collected by the »Alert» in the straits of Magellan and on the coast of Patagonia (Proc. Zool. Soc. London 1881, p. 88), a new species of *Strongylocentrotus*, named *Str. bullatus*. In discussing its relation to the other species of the genus BELL points out that »it seems to be the only species in which all the ocular plates are excluded from the anal system — presenting a considerable resemblance to *S. franciscanus*, in so far that the primary tubercles of the interambulacral areæ form, in both species, two rows, and are considerably larger than any others on the test. . . . . . So, again, a resemblance is to be seen to *S. albus* in the presence of the tubercles separating the arcs of pores; but these tubercles are much smaller and much more irregular in *S. bullatus*, and this new species has also a somewhat larger mouth (actinostome)».

In spite of the differences here pointed out I must regard *bullatus* as a synonym only of *albus*. Regarding the ocular plates there is, as has been shown above (p. 54), so considerable a variation that no reliable specific difference can be found in the relation of these plates to the periproct. The size of the tubercles separating the arcs of pores is likewise too variable to be relied upon, and likewise I cannot agree that they are more irregularly arranged in »*bullatus*» than in *albus*. Finally the size of the actinostome! On p. 425—26 of his paper »Observations on the characters of the Echinoidea IV. The Echinometridæ» (Proc. Zool. Soc. 1881) BELL gives some measurements of specimens of both species, one of each being 115 mm. in diameter; the percentage value of the actinostome for these two specimens is given as 20.9 in *albus*, 23.04 in *bullatus;* in the other specimens the percentage value of of the actinostome is calculated to 21.9, 24 and 27.4 for *albus*, 30.8, 31.6 for *bullatus*. For the specimens of which the measurements are given above (p. 53) the percentage value of the actinostome becomes: 25.05, 28.35, 30.42 and 22.13. This shows that the size of the actinostome is also too variable for being used as distinguishing character. The specimens measured here show the same range of variation in regard to this character as both the »species» of BELL — and that these specimens are really all the same species, can in no way be doubted. The distinguishing characters pointed out by BELL between *albus* and his species *bullatus* are thus irrelevant, and I am unable to find any better ones. Also the pedicellariæ are alike, as I have stated in the »Ingolf» Echinoidea I. (p. 123). (Regarding the small form of tridentate pedicellariæ described from »*Str. gibbosus*» (= *L. albus*) in this place, cf. above p. 55.) The colour of the test of *bullatus*, it is true, is described by BELL as »brownish red», which is not in accordance with the characteristic colouration of *albus* described above (p. 55). The reason of this difference, however, is no doubt to be found in the fact that BELL's specimens have been dried without having the skin cleaned off, which is rather thick and brownish pigmented. — The result is that BELL's *Strongylocentrotus bullatus* must be regarded as a synonym only of *Loxechinus albus;*

it does not even seem possible to maintain it as a distinct variety of *L. albus.* (I may state that I have examined the type specimens of *bullatus* in the British Museum.)

Besides the *Strongylocentrotus bullatus* Prof. BELL mentions in the place quoted a »*Strongylocentrotus* sp. inc.» (p. 89. Pl. VIII. figs. 3, 4). As there is nothing in the description or the figures which might indicate that to be another species, I cannot doubt that it is likewise *L. albus.* (I have not examined this specimen myself.)

In the »Challenger»-Echinoidea p. 106 Prof. AGASSIZ records *Strongylocentrotus gibbosus* from Stat. 304. Relying on this determination I referred in the »Ingolf»-Echinoidea I. (p. 123) the species *gibbosus* to the genus *Loxechinus*, finding the pedicellariæ of the »Challenger» specimen quite like those of *L. albus.* The examination of the type specimen of *gibbosus*, however, proved that this species has nothing to do with the genus *Loxechinus.* There can then scarcely be any doubt that the »*Strongylocentrotus gibbosus*» from the »Challenger» Stat. 304 is really *Loxechinus albus* (cf. »Ingolf» Echinoidea. I. p. 178).

From the critical remarks given above it seems evident that the South American Coast, from the La Plata River to Peru is inhabited only by the following littoral species of the Echinina: *Notechinus magellanicus*, *Sterechinus Neumayeri*, *St. Agassizii*, *Loxechinus albus* and *Toxocidaris gibbosus.* — PHILIPPI, in his paper »Über die chilenischen Seeigel» (Verh. d. deutschen wiss. Vereines zu Santiago. Chile. II. 1892, p. 247) records the following »Echiniden im engeren Sinn»: *Heliocidaris alba* MOL., *H. antarctica* PH., *H. erythrogramma* DECH. (sic!), *Echinus Cunninghami* PH., *rodula* PH., *lepidus* PH. and *magellanicus* PH. — The names *Helioc. antarctica*, *Echinus Cunninghami*, *rodula* and *lepidus* are, evidently, only nomina nuda. The first of them is supposed by PHILIPPI himself to be a variety only of »*Heliocidaris alba*», and for the three latter it will probably not be too rash to suggest that they will prove to be identical with the *Sterechinus* species or *Notechinus magellanicus.* In any case it is somewhat surprising to have nomina nuda introduced into literature at so late an epoch.*

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* The reproach of having introduced nomina nuda into the literature is raised against myself by LAMBERT & THIÉRY (Notes Échinologiques. I. Sur le genre Cidaris. Bull. Soc. Sc. Nat. Haute Marne. VI. 1909, p. 20), because I have preliminarily characterized some species by the pedicellariæ alone. As LAMBERT & THIÉRY wholly reject the pedicellariæ, as being of no classificatory importance at all (because they are generally not to be found in the fossil forms), their conclusion as regards such species is, thus far, correct. In reality the structural features of the pedicellariæ described and figured by me for such species (*Schizocidaris assimilis* e. g.) are so characteristic that the species is easily recognizable thereby; and as regards *Schizocidaris assimilis*, the species objected to, I may recall the fact that several other characteristic features are pointed out (Ingolf Ech. I. p. 25). But, of course, I agree that it is highly necessary that all such species should be completely described as soon as possible. (Cf. the Introduction of my paper »On some West Indian Echini». Bull. U. S. Nat. Mus. 1910).

Meridosternata.

Fam. **Urechinidæ.**

Plexechinus Nordenskjöldi MRTSN.

Pl. XVII, Figs. 1—8. Pl. XVIII, Figs. 5—12.

Plexechinus Nordenskjöldi TH. MORTENSEN.	1905.	Some new species of Echinoidea (Vidensk. Medd. Naturh. Foren. Köbenhavn, p. 242).
— — —	1909.	Die Echinoiden d. deutschen Südpolar-Exped. (Ergebn. d. deutsch. Südpolar-Exp. XI. Zoologie. III. p. 82).

The test is elongate, egg-shaped, only slightly flatter in front. The actinal side is rather flat, somewhat deepened in front of the actinostome; the odd interambulacrum forms a slightly prominent keel, which ends in an anal snout, surrounded by a distinct fasciole. The periproct is placed rather high on the abactinal side. In profile the outline of the test resembles that of *Pl. cinctus*, only the anal snout is somewhat more pointed. The whole of the test is covered by a dense coat of short miliary spines among which the rather coarse, not very numerous, primary spines stand out prominently.

The actinostome (Pl. XVII Fig. 2) is somewhat before the middle; it is slightly elongate, with a circle of larger plates, each bearing a pair of tubercles (spines), along its border and some smaller plates within; the mouth is eccentric, nearer the posterior edge. The anterior part of the actinostome is distinctly sunken, the mouth-opening becoming thus almost vertical — a very interesting feature, pointing towards the vertically placed actinostome of the Pourtalesiæ.

The odd interambulacrum has the labrum in contact with the second plate (Pl. XVII Figs. 2, 5), not separated from it through the junction of the ambulacral plates I. a_2 and V. b_2, as is the case in *Pl. cinctus* and sometimes also in *Pl. hirsutus*. (In the figured specimen the ambulacral plate V. b_1 is abnormally elongate.) The sternum is very large, and the same holds good for the two episternal plates. The fasciole traverses the outer end of these two plates, encloses completely the following pair of plates, which are very small, and traverses the plates 5 a_4 and b_5. The fasciole thus comprises only three pairs of interambulacral plates, while in the two other species of the genus it comprises four pairs. The three following plates, a_{5-7} and b_{6-8}, enclose the periproct. (In *Pl. cinctus* and *hirsutus* the first plates reaching the periproct are a_6 and b_7.) The two plates a_5 and b_6 are not lengthened (Fig. 13). (For comparison a figure is also given of the periproctalregion of *Pl. hirsutus* (Fig. 14), which has not been given in the »Ingolf» Echinoidea, where this species was described.) The periproct is not sunken; the whole posterior end sloping rather gently. — Regarding the other interambulacra it is only to be noticed that the anterior paired ones agree with those of the other species in the second plate being compound (2 + 2). — The anterior ambulacrum is distinctly depressed towards the mouth; towards the apical system the plates become somewhat lower than in the other ambulacra. In the posterior paired ambulacra it is the 4th plate which reaches within the fasciole, in the usual way.

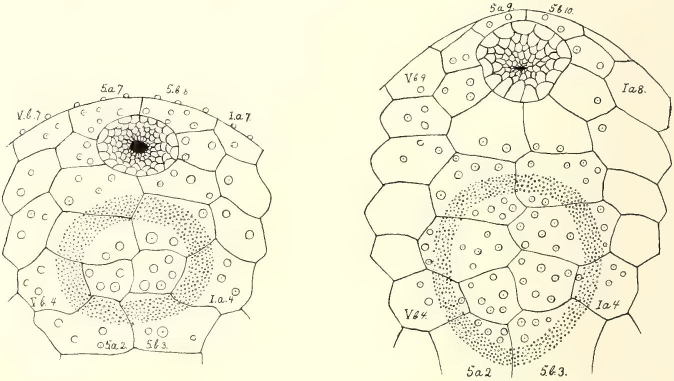

Fig. 13.

Fig. 14.

Figs. 13—14. Periproctal region of *Plexechinus Nordenskjöldi* (13) and *Pl. hirsutus* (14). 7/1.

The apical system, which is somewhat sunken along the median line, is very interesting, being of a quite primitive structure (Pl. XVII Fig. 1). All the four genital plates are distinct, each with a genital pore covered by a long genital papilla; they join in the middle, the anterior and posterior pair being separated only by the anterior paired oculars, which likewise join in the middle. The apical system thus affords a very conspicuous difference from the two other species of the genus.

The primary tubercles are more scarce than in *Pl. hirsutus* and *cinctus*. On the abactinal side most of the plates carry only one primary tubercle each, while on the sides and on the actinal side there are 2—3, sometimes 4, primary tubercles on each plate. For the rest the plates are closely covered with miliary tubercles. Only few tubercles occur round the peristome, so that one cannot speak of a bourrelet here. The ambulacral plates along the sternum are likewise covered with secondary and a few primary tubercles. — a conspicuous difference from the smooth plates in the two other species.

The primary spines are rather coarse, pointed, slightly curved, with none or only a few serrations; the spines of the actinal plastron are likewise pointed, not widened in the end; those around the peristome are not flattened. They all stand out very prominently, white against the more or less violet ground colour of the test. Those of the subanal plastron are the longest, 2.5 mm. in a specimen of 9 mm. length. — The secondary spines are widened at the point and somewhat curved (Pl. XVIII Fig. 9).

The tubefeet on the inner circle of plates round the peristome are penicillate, with only 1—4 thick filaments, supported by very strong, irregular, fenestrate rods (Pl. XVIII Fig. 10). No spicules were found in these tubefeet. The simple tubefeet following next have a small cap of calcareous network in the point, and some few simple spicules occur in their walls.

The pedicellariæ are rather scarce; only tridentate, ophicephalous and triphyllous pedicellariæ have been observed. They are upon the whole very similar to those of *Pl. hirsutus*, the tridentate ones being only a little more irregular (Pl. XVIII Figs. 6, 11); bivalve specimens occur. The triphyllous pedicellariæ (Pl. XVIII Fig. 7) are like small tridentate. A form corresponding to the globiferous pedicellariæ of *Pl. hirsutus* I have not found. The ophicephalous pedicellariæ (Pl. XVIII Figs. 5, 12) are more developed than those of *Pl. hirsutus*, the blade being somewhat broader; the upper end of the stalk cup-shaped as usual.

Sphæridiæ occur only on the plates nearest the peristome, also in the anterior ambulacrum. They are short, round, with rather prominent ridges (Pl. XVIII Fig. 8).

The colour was brownish-violet in the one specimen, white with faint traces of violet pigment in the other.

Two specimens were taken at Station 17, on the Shag Rock Bank (53° 34′ S. 43° 23′ W. 160 m. — Sand, gravel; bottom temperature + 2.05). The measurements are:

Length.	Breadth.	Height.
12 mm.	9 mm.	7 mm.
9 »	6.5 »	6 »

It may be especially noticed that also the smaller specimen has its genital papillæ developed. It is thus probably a very small form.

This very interesting species differs conspicuously from the two other species known of the genus *Plexechinus*, *Pl. cinctus* and *hirsutus*, especially by its primitive apical system, by the fasciole comprising only 3 pairs of interambulacral plates and upon the whole by the structure of its epiproctal region. Perhaps these characters would even justify making it the type of a separate genus; but since it otherwise agrees so closely with the other species I have thought it better to refer it to the genus *Plexechinus*, which represents, in any case, its nearest relation.

The marked deepening of the anterior ambulacrum and the actinostome is a highly interesting feature, pointing distinctly towards the Pourtalesiæ. This species, much more than the two other species hitherto known of the genus, tends to mark the genus *Plexechinus* as a connecting link between the *Urechinidæ* and the *Pourtalesiidæ;* but still the urechinid affinities are the most prominent. (Cf. »Ingolf» Echinoidea. II, p. 57—58.)

Amphisternata.

Fam. **Spatangidæ.** [1]

The South American Spatangoids of the *Abatus*-group have a very interesting and rather intricate history. The first author to treat of them was PHILIPPI, who in 1845 in his paper »Beschreibungen einiger neuen Echinodermen, nebst kritischen Bemerkungen über einige weniger bekannten Arten» (Arch. f. Naturgesch. XI. I p. 344) establishes three species, viz. *Tripylus excavatus*, *cavernosus* and *australis.* While L. AGASSIZ & DESOR in their »Catalogue raisonné des Échinides» (1846) refer *Tr. excavatus* to *Agassizia* and the two other species to *Brissopsis*, TROSCHEL goes another way, establishing a subgenus, *Hamaxitus*, for *Tr. excavatus* and another subgenus, *Abatus*, for *cavernosus* and *australis* (»Über die Gattung Tripylus». Arch. f. Naturgesch. 1851). Next GRAY in his »Catalogue of the Recent Echinida» (1855) refers the two latter species to his genus *Faorina*, to which genus he likewise refers the species *antarctica* described by him in 1851 (Descriptions of some new genera and species of Spatangidæ in the British Museum. Ann. Nat. Hist. 2 Ser. VII. p. 130). Later on (1872) A. AGASSIZ in the »Revision of Echini» refers the same two species to the genus *Hemiaster* (*Faorina antarctica* being made a synonym of *H. cavernosus*), and in the »Hassler»-Echini (1874 p. 20) he points out that *H. australis* is in all probability the young of *H. cavernosus.* Subsequently, in the »Challenger» Echinoidea (1881 p. 184) AGASSIZ has come to the conviction that »there seems but little doubt the species which have thus far been distinguished as Hemiaster australis, Hemiaster philippii [2] and Hemiaster cavernosus are all different stages of growth of one and the same species»; he likewise unites with this species the *H. cordatus* described by VERRILL from Kerguelen (1876). The same course was, for the rest, already previously adopted by STUDER in his paper on the »Gazelle» Echinoidea (1880). BERNARD (Échinides recueillis par l'expédition du Cap Horn 1882—1883. Bull. du Mus. d'hist. nat. 1895. No. 7) goes even farther, uniting with his *Tripylus cavernosus* not only the two species *australis* and *philippi* (*cordatus* is not named) but also *Tripylus excavatus* PHIL. — MEISSNER in 1896 (Die von Herrn Dr. PLATE aus Chile heimgebrachten Seeigel) maintains *Tripylus excavatus* as distinct besides *Hemiaster cavernosus*, under which latter the rest (*australis*, *antarctica*, *philippi* and *cordatus*) are included as synonyms. The same course is followed in his paper »Die Echinoiden d. Hamburger Magalhaensischen Sammelreise» 1900, where he further includes under *Hemiaster cavernosus* some specimens distinguished by PFEFFER with the M.S. name *Hemiaster Agassizii.* — Recently two new species have been described, viz. *H. gallegosensis* from Patagonia (DE LORIOL, Notes pour servir à l'étude des Échinodermes. 2 Sér. II. 1904) and *H. elongatus* from the South Orkneys (R. KOEHLER, Astéries, Ophiures et Échinides de l'Expédition antarctique nationale Écossaise. Trans. R. Soc. Edinburgh. XLVI. 1908). While DE LORIOL is inclined to regard all the previously described species as distinct, KOEHLER joins DÖDERLEIN (Echinoiden d. deutschen Tiefsee-Expedition 1906) in regarding *australis*, *cordatus* and *philippii* as synonyms of *Hemiaster cavernosus.* (In »Résultats du Voyage du S. Y. Belgica, 1897—1899. Zoologie. Échinides et Ophiures. 1901, p. 13 Prof. KOEHLER expresses the opinion that also *Tripylus excavatus* should be made a synonym of *Hemiaster cavernosus.*) The same view, evidently, is held by Prof. BELL (Echinoderma of the National Antarctic Expedition 1908), though not stated explicitly; he only states he is inclined to follow A. AGASSIZ in regarding *Tripylus excavatus* as distinct. — Finally, it may be mentioned that PHILIPPI (Über die chilenischen Seeigel. Verh. d. deutschen naturwiss. Vereins. Santiago. 1892) names, besides *Tripylus excavatus*, *cavernosus*, *australis*, also *Tr. cordatus* (without author name) and *Tr. Scythei* PHIL. The latter is evidently meant as a new species, but as it is a nomen nudum, it has to be dropped.

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[1] On referring the following forms to the family *Spatangidæ* I wish to state expressly that it is not meant as an expression of my views on the classification of the *Amphisternata.* I hope to be able to set forth my views hereon in the Part II of my »Siam-Echinoidea».

[2] Meantime established by LOVÉN in 1871.

Besides the above mentioned species the following related forms have been described: *Tripylus Philippii* GRAY (Ann. N. H. 1851), *Schizaster Moseleyi* A. AG. (Challenger Ech.), and a couple of new genera have also been established more recently, viz. *Spatagodesma* (*Diomedæ*) by A. AGASSIZ 1898 (cf. Panamic Deep Sea Echini 1904 p. 198) and *Amphipneustes* (*Lorioli*) by KOEHLER (Échinides et Ophiures de »Belgica» 1901). The former is regarded by its author as nearest related to *Agassizia;* as I have shown (»Ingolf» Echinoidea II. 1907, p. 114), it is evidently only the young of either *Abatus* or *Schizaster* (*Brisaster*). The latter is regarded by the author as being nearest to *Palæopneustes;* it is also very nearly related to

Abatus, as will be shown later on. For the present this form may be left out of consideration, as also the *Schizaster* (*Brisaster*) *Moseleyi* A. AG., while there will be reason to discuss the *Schizaster* (*Tripylus*) *Philippii* (GRAY) together with the other species mentioned above.

There have thus been established no less than 8 species of the »*Hemiaster*» (*Abatus*)-group from South America viz.: *Tripylus excavatus* PHIL., *cavernosus* PHIL., *australis* PHIL., *Faorina antarctica* GRAY, *Abatus Philippii* LOVÉN, *Hemiaster Agassizii* PFEFFER, *H. gallegosensis* DE LORIOL and *H. elongatus* KOEHLER, which have been regarded as synonyms in different ways, even made one species altogether (except *gallegosensis* and *elongatus*, which have evidently only their recent date to thank for not having likewise been made synonyms of *cavernosus*). To these must be added the Kerguelen-species, *cordatus*, likewise generally regarded as a synonym of *cavernosus*. It was then very desirable to have all these forms thoroughly reexamined, and the Swedish South Polar Expedition has given me the occasion to undertake that work. Though the material collected by this Expedition is rather large (the collection of the Swedish Fuegian Expedition 1895—97, likewise placed at my disposal, contains only little material of these forms), it would not suffice for a thorough revision of the whole group. I have therefore made every effort to get as much material as possible, and especially to have the type specimens reexamined. Everywhere I met the greatest liberality, for which I may express my deep gratitude. Professor LUDWIG sent me the co-types of PHILIPPI's *Tripylus excavatus*, *australis* and *cavernosus;* Prof. THÉEL sent me the type of LOVÉN's *Abatus Philippii*, together with some other specimens identified by LOVÉN. From Prof. JOUBIN I have received one of BERNARD's specimens, and from Dr. MEISSNER I received some of the specimens mentioned by him in his paper on the Chilenian Echini. DE LORIOL sent me a pair of specimens of his *Hemiaster gallegosensis*, and from the Hamburg Museum I received the types of PFEFFER's *Hemiaster Agassizii* together with the whole rich material of South American Spatangoids contained in the collections of this Museum. Further I have examined in the British Museum the type specimens of GRAY's *Faorina antarctica* and the specimens from the »Challenger», and lastly I had the rich material of *Abatus cordatus* collected at Kerguelen by the German South Polar Expedition. It must be conceded, therefore, that I have done my best to secure a good basis for my researches on this group of Spatangoids.

We may first examine the value of the genera *Tripylus* and *Abatus*. (That the *Abatus*-species have no nearer relation to *Hemiaster*, with which genus they have for so long time been associated, I think I have shown definitely in »Die Echinoiden d. deutschen Südpolar-Expedition» p. 90—91, the main differences being 1) that in *Abatus* the apical system is ethmolytic, with 2—3 genital openings, while in *Hemiaster* it is ethmophract, with 4 genital openings, and 2) that in *Abatus* a latero-anal fasciole is present, at least in the young, while in *Hemiaster* such a fasciole is never developed.)

The genus *Tripylus* was established by PHILIPPI (Op. cit.); though not definitely diagnosed, it is stated to be based on the single character of having only 3 genital openings. This is certainly an insufficient character, and upon this ground also *Brisaster fragilis* and allied species would have to be referred to the same genus, as was, indeed, — and thus far correctly — done by M. SARS (Middelhavets Littoral-Fauna II. p. 62). TROSCHEL in his paper »Über die Gattung Tripylus» p. 72, after justly criticizing the reference of PHILIPPI's three species to the genera *Brissopsis* and *Agassizia* in AGASSIZ & DESOR's »Catalogue raisonné des Échinides» gave the following diagnosis of the genus *Tripylus:* »Testa cordata, suborbiculari, convexa; ambulacris profundatis, anterioribus subtransversis; polo dorsali subcentrali; poris genitalibus tribus (antico sinistro, posticis sinistro et dextro); semita ambulacra includente.» He further distinguishes the three subgenera *Hamaxitus* (*excavatus*), *Atrapus* (*grandis* TROSCH.) and *Abatus* (*cavernosus*, *australis*) alone by the different development of the latero-anal fasciole: complete in the first, incomplete in the second and wholly wanting in the third. GRAY (Catalogue of Recent Echinida 1855, p. 58) gave the following diagnosis of the genus: »Shell cordate, rather depressed; tubercles equal; apex central; ambulacra sunken; the lateral radiating, the anterior pair elongated, the hinder pair short; the odd anterior one deep, forming a distinct anterior groove, with a series of small double pores on each side; surrounded by a very flexuous peripetalous fasciole, with a lateral fasciole separating from it and descending under the vent; ovarial pores three or four.» In the genus thus diagnosed he includes the species *excavatus* PHIL. and *Philippii* GRAY. In the »Revision of Echini» AGASSIZ confines the genus *Tripylus* to include only the species *excavatus* PHIL., giving this diagnosis (p. 588): »Test depressed heart-shaped; apical system anterior; lateral ambulacra sunken; anterior groove slight. Actinal side flat. Peripetalous fasciole, with continuous lateral and anal fasciole.» (It is regarded as a subgenus of *Hemiaster*, representing the »*Schizaster* type» of that genus.) I do not find in this diagnosis a single really characteristic feature; one of the characters mentioned, »apical system anterior«, evidently would be of importance, if it were correct — but it is not. The apical system is central — as stated by TROSCHEL and GRAY — sometimes perhaps slightly anterior, sometimes slightly posterior, but so little that the only correct thing is to say, it is central. — DUNCAN (Revision of the Genera and great Groups of Echinoidea. Journ. Linn. Soc. Zoology. XVIII. 1889, p. 231) places *Tripylus* (including *Abatus* as a synonym) as a subgenus of *Hemiaster*, and the same course is followed by DELAGE & HÉROUARD in their »Traité de Zoologie concréte. III. Échinodermes. 1903, p. 271), while MEISSNER (Bronn.

Classen u. Ordnungen. Echinodermen. IV. Die Seeigel 1904, p. 1390) makes both *Tripylus* and *Abatus* synonyms of *Hemiaster*.

Though I cannot agree with AGASSIZ in the diagnosis given by him for the genus *Tripylus*, I agree with him in regarding the species *excavatus* as the type of a separate genus, *Tripylus*, based on the following characters: The anterior lateral ambulacra are not petaloid in their whole length from the apex down to the peripetalous fasciole; the 3—5 lower plates have only simple pores, a feature reminding one, in fact, somewhat of *Agassizia* and not found in any of the other South American forms of the present group. The tubefeet of the odd ambulacrum are very small and rather distant, with no distinct rosette plates and a quite rudimentary sucking disk. These two characters, together with the well developed latero-anal fasciole, evidently justify separating it from *Abatus* as a distinct genus, which, of course, has to keep the name *Tripylus* PHIL.; the name *Hamaxitus* TROSCHEL can only be a synonym of *Tripylus*. All the other species, *cavernosus* etc., agree in having no or only a rudimentary latero-anal fasciole (excepting the young ones); the anterior lateral ambulacra are petaloid in their whole extent down to the peripetalous fasciole; the tubefeet of the frontal ambulacrum have a rather well developed sucking disk and rosette plates (least so in *cordatus* and *Agassizii*). These species evidently make a natural group, for which the generic name *Abatus* TROSCH. has to be retained. — In the pedicellariæ additional characters for distinguishing these two genera are, apparently, not found. Both in *Tripylus* and *Abatus* we find a very characteristic form of rostrate pedicellariæ (Pl. XIX Figs. 30, 38), with the blade quite open, almost flat, not widened in the point and generally very little bent. Globiferous pedicellariæ have not been found in *Tripylus;* in *Abatus* they are of the *Schizaster*-type, with interior gland-room, and with 2—3 rather long teeth on either side of the opening (seldom with only one tooth on either side).

The species *Tripylus Philippii* GRAY was removed to the genus *Schizaster*, nearest to *S. fragilis*, by AGASSIZ in the »Revision of Echini» (p. 612) with the remark that, after it has been shown »that the number of genital openings alone is not a suitable generic distinction, and after LÜTKEN's exhaustive comparison and analysis of the reasons for uniting T. fragilis to Schizaster, there is no necessity for further discussion of the question of the generic affinity of these two species.» * I cannot at all agree with AGASSIZ here. As I have shown in the »Ingolf» Echinoidea II. p. 120—123, the species hitherto referred to the genus *Schizaster* form several distinct groups or subgenera, viz. 1) the forms with high test, posterior apical system, 2 genital pores and the globiferous pedicellariæ with a circle of teeth round the terminal opening (*Schizaster* s. str., with type species: *canaliferus* LAMK.); 2) the forms with low test, posterior apical system, 3 genital pores and the globiferous pedicellariæ ending in a single tooth (subgenus *Brisaster*, with type species: *fragilis* DÜB. KOR.). A third group is probably formed by the species with 4 genital pores, *gibberulus* AG. and *Savignyi* FOURTAU, for which the name *Paraster* POMEL should be used, and finally a fourth group is formed by the species *Philippii* GRAY, for which the name *Tripylaster* is proposed. The characters by which this latter group is distinguished from *Brisaster* are: the subcentral position of the apical system and the structure of the globiferous pedicellariæ, which have the terminal opening surrounded by four teeth. (The *Br. capensis* (STUDER) is, however, very similar to *Philippii* as regards the shape of the test.) To *Abatus* this species bears several resemblances, but the distinct latero-anal fasciole, the not deepened petals, besides some minor differences in the pedicellariæ separate it clearly from that genus. It may well be said to stand between *Abatus* and *Brisaster*, but the affinities seem to be more close to the latter. From the genus *Tripylus* it differs markedly in the structure of the petals; unfortunately the globiferous pedicellariæ of *Tripylus* are still unknown, but it can scarcely be doubted that it will ultimately be found to agree with *Abatus* in the structure of these pedicellariæ, as it does in the structure of the rostrate pedicellariæ.

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* It is not quite correct when it is stated in the »Revision of Echini» (p. 612) that GRAY referred his species to *Tripylus* »on the same grounds which induced SARS to refer its northern congener to it», viz. the three genital pores. GRAY does not give the number of the genital pores as a chief character of the genus *Tripulus*, saying in the diagnosis of the genus »ovarial pores three or four» (Catalogue Rec. Ech. p. 58). The character upon which GRAY distinguishes the genus *Tripylus* from *Schizaster* he expressly says to be »the regular cordate form and central vertex» (Op. cit. p. 59).

The question of the species within the genus *Abatus* is very difficult to settle. The pedicellariæ, which are in so many cases of very great importance for discriminating the species, are only of small use in this regard in the present group. Globiferous pedicellariæ have been found only in two species: *cavernosus* and *elongatus*, and in the former, moreover, they occur in two very distinct types with 2—3 teeth on either side of the terminal opening or with only one tooth on either side (Pl. XIX Figs. 28, 29, 33 to compare with fig. 32 and 39); one would rather think them to form a generic than a specific distinction — but the specimens with these two different forms of globiferous pedicellariæ are so much like each other that — judging from the material in hand — it seems impossible to distinguish them by any other character. I think it correct to note this form as a variety of *cavernosus* (var. *bidens*), but I cannot give any other character for it than the pedicellariæ. In *A. elongatus* the globiferous pedicellariæ have only one tooth on either side of the opening. — The tubefeet afford one character of importance for distinguishing the species, viz. in the subanal tubefeet; these may be penicillate in the usual way, or they may be quite rudimentary, not penicillate. The latter case obtains in *A. cordatus* and in one of the South American species, *A. Agassizii* (PFEFFER). Also the petals afford some good distinguishing characters, though the most prominent feature, whether they are deepened or not, the main character upon which Philippi distinguished his two »species» *cavernosus* and *australis*, is only a sexual difference. The relative size of the petals differs conspicuously: the posterior petals are as long as or even a little longer than the anterior ones in *Agassizii*, somewhat shorter in *cavernosus*, much shorter in *Philippii*. The frontal ambulacrum is flush with the test in *Agassizii*, deepened in the other species. *A. Philippii* has only the anterior paired petals deepened in the female, while the other species have both the anterior and the posterior petals deepened. The number of genital pores cannot, on the other hand, be used as a certain specific character, two or three pores occurring equally frequently in *A. Philippii* (which species was distinguished by Lovén mainly by the supposed character of having only two genital pores); also in typical *A. cavernosus* two genital pores may occur. (Philippi says, in his paper »Über die chilenischen Seeigel»: »Ich kenne jetzt noch eine Art, bei welcher auf der linken Seite gar kein Eierstock liegt»; probably this will turn out to be an individual abnormality of one of the known species.) — The position of the apical system is generally central in all the species, but in some specimens of *cavernosus* it is distinctly posterior, without any other characters distinguishing these specimens from the typical form; they can certainly not even be made a separate variety, all transitional forms occurring. Other specimens differ from the typical *cavernosus* in the unusual height of the test; but here likewise transitional forms occur.

After all I think we may distinguish with certainty the following species of the genus *Abatus: cavernosus* (Phil.) (with the synonyms *australis* Phil. and *gallegosensis* De Loriol), *Agassizii* (Pfeffer), *Philippii* Lovén and *cordatus* (Verrill). As for *A. elongatus* (Koehler) I am much inclined to think that it will prove to be identical with *A. Agassizii*.

Abatus cavernosus (Phil.).

Pl. IX. Pl. X, Figs. 2, 4, 6—8, 10—13. Pl. XVII, Fig. 9. Pl. XVIII, Figs. 3—4. Pl. XIX, Figs. 28—30, 32—33, 35—39, 41—43, 45—46, 50—51.

Tripylus cavernosus Philippi. 1845. Beschreibung einiger neuen Echinodermen. Arch. f. Naturgesch. XI. 1. p. 345. Taf. XI. Fig. 2.
— *australis* — Ibidem, p. 347. Taf. XI. Fig. 3.
Brissopsis cavernosus L. Agassiz & Desor. 1847. Catalogue raisonné des Échinides. Ann. Sc. nat. 3 ser. VIII, p. 15.
— *australis* — — Ibidem.
Tripylus (*Abatus*) *cavernosus* Troschel. 1851. Über die Gattung Tripylus. Arch. f. Naturgesch. XVII. 1. p. 72.
— — *australis* — — Ibidem.
Faorina cavernosa Gray. 1855. Catalogue of recent Echinida, p. 57.
— *australis* — — Ibidem.
(?) *Hemiaster cavernosus* A. Agassiz. 1881. »Challenger» Echinoidea p. 177 (pro parte).

Tripylus cavernosus (pro parte) BERNARD. 1895. Échinides du Cap Horn. Bull. Mus. d'hist. nat. Paris, p. 273.
Hemiaster — (pro parte) MEISSNER. 1896. Seeigel v. Chile (Dr. Plate). Arch. f. Naturgesch. LXII. 1. p. 87.
— *gallegosensis* DE LORIOL. 1904. Notes pour servir à l'étude des Échinodermes. 2 Ser. II, p. 5. Pl. I, 1.

Non: *Tripylus excavatus* PHILIPPI.
Hemiaster cordatus VERRILL.
Abatus Philippii LOVÉN.
Hemiaster Agassizii PFEFFER.
— *cavernosus*, *australis* A. AGASSIZ. Revision of Echini, p. 587. Pl. XXI. c. Figs. 1—2 (= *A. Agassizii*).
— — A. AGASSIZ. Viviparous Echini from the Kerguelen Islands. Proc. Amer. Acad. Arts & Sciences. N. Ser. III, 1876, p. 231 (= *A. cordatus*).
— — EDG. SMITH. Zool. Coll. made in Kerguelens Land . . . Transit of Venus Exped. Echinodermata. Philos. Transact. Vol. 168, 1879, p. 271 (= *A. cordatus*).
— — STUDER. Über Geschlechtsdimorphismus bei Echinodermen. Zool. Anzeiger 1880, No. 67—68. Fig. 10 (*A. cordatus*).
— — STUDER. Übersicht d. Echinoidea d. »Gazelle». Monatsber. d. Berliner Akad. 1880. p. 881 (partly *A. cordatus*, partly uncertain, viz. the specimens from Patagonia).
Abatus cavernosus LOVÉN. 1883. On Pourtalesia p. 72. Pl. XIV (*A. cordatus*).
Hemiaster — MEISSNER. 1900. Echinoideen d. Hamburger Magalh. Sammelreise p. 13 (*A. Agassizii*).
Abatus — A. AGASSIZ. 1904. Panamic Deep Sea Echini, p. 211. Pl. 99 (*A. cordatus*).
Hemiaster — DÖDERLEIN. 1906. Echinoiden d. deutschen Tiefsee Exped. p. 248. Taf. L, 6—7 (*A. cordatus*).

Uncertain: *Faorina antarctica* GRAY.
Hemiaster cavernosus BELL. 1902. Echinoderma of the »Southern Cross», p. 219.
— — — 1908. — — National Antarctic Expedition p. 6.
— — KOEHLER. 1908. Astéries, Ophiures et Échinides de l'Expéd. antarct. nationale Écossaise. Trans. R. Soc. Edinb. XLVI, p. 621.
Spatagodesma Diomedæ A. AGASSIZ. 1904. Panamic Deep Sea Echini, p. 200. Pl. 106—107.

The enormous list of literary references given by MEISSNER under the heading of »*Hemiaster cavernosus*» in the two papers quoted is for the greatest part erroneous, as seen by the list given above. As certain references can only be given those named here. (A few citations, where alone the names are given, have been omitted.) Perhaps there may be some true *A. cavernosus* among the »Challenger»-specimens, but most of them, at least, are *A. cordatus;* those from Stat. 310 (p. 184) are partly *A. Philippii.* — Among the specimens mentioned from Chili by MEISSNER there is at least one *Tripylus excavatus* (sent to me for examination). That DE LORIOL's *Hemiaster gallegosensis* is synonymous with *A. cavernosus* cannot be doubted; but DE LORIOL can in no way be blamed for having established it as a separate species. He has trusted that the species described by A. AGASSIZ as *H. cavernosus* was really identical with PHILIPPI's species; it is, however, not so, the *H. cavernosus* (and *australis*) of the »Revision of Echini», being *A. Agassizii*, while that mentioned in the »Challenger» Echinoidea is *A. cordatus.* But DE LORIOL was quite right that his specimens represented another species.

To the description of *A. cavernosus* given by PHILIPPI and, especially, by DE LORIOL (under the name *gallegosensis*) the following remarks may be added.

The hinder part of the labrum does not reach beyond the first ambulacral plate. The labrum carries small spines and pedicellariæ. There are generally 5 well developed subanal tubefeet, the first of them occurring on the 6th—7th ambulacral plate. The peripetalous fasciole passes over the 15th—16th plates of the posterior ambulacra. Genital pores generally 3, sometimes only 2. The test is often unequally developed, the right side projecting distinctly beyond the left. The petals are stated by DE LORIOL to have »une tendance marquée à s'effiler à l'extrémité»; they are certainly slightly narrower at the lower end, where they join the fasciole, but they are still distinctly petaloid in their whole length, in marked difference from *Tripylus excavatus*. The latero-anal fasciole may be rather distinct in young specimens, and also sometimes in larger specimens.

The spines are rather coarse, as in all the *Abatus*-species. — The spicules are irregular spinous or ramose rods, well developed in the tubefeet of the frontal ambulacrum, very feebly developed in those round the mouth. The sucking disk is well developed in the tubefeet of the frontal ambulacrum, the edge of the disk not lobate; the rosette plates are broad and well developed, though not reaching the edge of the disk. — The sphæridiæ are generally much grooved.

The pedicellariæ occur in three forms, viz. globiferous, rostrate and tridentate. The globiferous pedicellariæ (Pl. XIX Figs. 28—29, 33), which do not occur on all the specimens, are rather large, the valves enclosed by a thick, brown, evidently glandular skin. The valves have, as in *Schizaster*, an interior gland cavity, opening at the point of the valve. The opening is surrounded by 2—3 teeth on either side, sometimes, however, there may be only one tooth on the one side, 2—3 on the other. The sides of the basal part rather narrow; the blade is rather strongly curved. There is no neck; the stalk is simple, without distinct thickening at either end. — The rostrate pedicellariæ (Pl. XIX Figs. 30, 38, 45) have a rather deep blade with more or less serrate edges; the outer end is narrowed. The valves are generally not much curved. The neck is well developed, the stalk simple. — The tridentate pedicellariæ (Pl. XIX Figs. 37, 46, 50—51) occur with two or three valves indifferently; the larger samples, however, are all three-valved. They reach a size of about 1,3 mm. length of head. The blade is simply leaf-shaped; in the larger ones there may be some meshwork on the outer side of the blade. In the smaller ones the edges join in their whole length, in the larger they are apart for some distance below, up to half the length of the blade, this part being accordingly narrowed. The edge is finely serrate in the outer, joining part, with more or fewer coarser serrations in the lower part. The valves of the 2-valved specimens are somewhat compressed, otherwise not differing essentially from those of the 3-valved; the apophysis is distinct, though generally less prominent than in the threevalved specimens. The neck s well developed, in the larger specimens shorter; the stalk is simple. Quite small pedicellariæ of this form might equally well be taken to represent the triphyllous form; there is no character distinguishing them definitely from the smaller tridentate pedicellariæ (Pl. XIX. Figs. 36, 43).

The colour is stated by PHILIPPI to be white; this, evidently, depends on the preservation. Most of the specimens seen by me are brownish, generally rather dark, both test and spines; a few of them are dark-violet.

On many of the specimens is found a parasitic or commensalistic Bivalve Mollusc, which, as I am informed by Mr. H. LYNGE, belongs to the genus *Lepton*. The specimen figured in Pl. X. 13 shows several samples of these Molluscs on the abactinal side. They are especially found in the marsupia and near the peristome. — It is highly interesting that it proves to be specifically distinct from the species occurring in exactly the same manner on the nearly related Kerguelen-form, *Abatus cordatus*, viz. *Lepton parasiticum* DALL. The deep sea between Kerguelen and South America thus forms a boundary for both the host and its parasite (commensaliste). On the other hand the *Lepton*-species found on *A. cavernosus* is likewise found on *A. Agassizii*, which occurs together with, or in the same regions as *A. cavernosus*. — The other parasitic Bivalve Mollusc, *Scioberetia australis*, described by BERNARD from *A. cavernosus* was not found on the specimens in hand.

The specimens of *A. cavernosus* before me differ so much in the shape of the test that, on comparing the extreme forms, one would hardly think it possible that they could really belong to the same species. There are, however, so many intermediate forms that it seems quite impossible to distinguish them with certainty by the shape of the test, and no characters being found in the pedicellariæ or other appendages of the test by which to distinguish them, they must all be regarded as belonging to the same species, affording a very considerable range of variation. The height of the test I have found varying from 58—72 %, the breadth from 90—96 % of the length. In Pl. X are figured some of the different forms. One form alone can be regarded as a separate variety, viz. the var. *bidens*, which is distinguished by its peculiar globiferous pedicellariæ (Pl. XIX. Figs. 32, 39). They differ very conspicuously from those of the typical form, the valves ending in two long teeth, with a short opening or slit below on the inside of the blade. Also the tridentate pedicellariæ (Pl. XIX. Figs. 35, 42) differ somewhat from those of the typical form in the blade being more rounded. Though the pedicellariæ thus afford very marked distinguishing characters I have been unable to find any such characters in the test or the other structures, and it has thus been thought right to separate this form only as a variety of *cavernosus*.

Among the material from the Hamburg Museum there is a specimen, labelled Patagonian Bank, 46° S., 60 fms., whose tridentate pedicellariæ differ somewhat from those of the typical form (Pl. XIX. Fig. 41); in this specimen also a 4-valved pedicellaria was found. The latero-anal fasciole is strongly developed, while the anal tubefeet are less developed than in the typical form, there being only 2 on one side and 1 on the other. Perhaps this specimen is the representative of another variety (or species?). The scanty material in hand does not allow me to form a definite opinion thereon.

The species was taken by the Swedish South Polar Expedition at the following stations, all off South Georgia:

Stat. 18 (54°15′ S. 36°25′ W. 250 m.). 2 specimens.
» 22 (54°17′ S. 36°28′ W. 75 m.). Numerous specimens of all different sizes.
» 23 (54°23′ S. 36°26′ W. 64—74 m.). Several small specimens.
» 30 (54°24′ S. 36°26′ W. 125 m.). 1 specimen.
» 31 (54°24′ S. 36°22′ W. 210 m.). 1 specimen.
» 32 (54°24′ S. 36°22′ W. 195 m.). 4 specimens.
» 33 (54°22′ S. 36°28′ W. 22 m.). 1 small specimen.
» 34 (54°11′ S. 36°18′ W. 252—310 m.). Several small specimens.

The var. *bidens* occurs among the specimens from the Stations 22 and 23.

By the Fuegian Expedition a small specimen of *A. cavernosus* was taken at 52°38′ S 70° W. 46 m. — Among the material received from the Hamburg Museum there are some specimens from the Magellan Strait and one from Juan Fernandez.

The species is as yet known with certainty only from the Southern Extremity of South America (Magellan Strait, off Rio Gallegos), further from South Georgia and Juan Fernandez. Probably it will prove to occur a considerable way north along the Atlantic as well as along the Chilian Coast, as also at the Falkland Islands. On account of the confusion which has hitherto obtained in the species of the genus *Abatus* the numerous indications of the occurrence of »*Hemiaster cavernosus*» at Kerguelen, the Antarctic Coast etc., are not to be taken as certain, though it is highly probable that e. g. the localities »off La Plata», the Falkland Islands, will prove correct — whereas it will most probably be found that all the indications of its occurring at the Kerguelen-group are founded on a confusion with *A. cordatus*. — The bathymetrical range of the species as hitherto known with certainty is from shallow water to about 300 m.

The collection of the Swedish South Polar Expedition contains an excellent series of developmental stages of *A. cavernosus*, from the embryos within the marsupium to the fullgrown specimens. A few young stages of *Abatus cordatus* have been described and figured (under the name of »*Hemiaster cavernosus*») by A. AGAS-

SIZ (»Challenger» Echinoidea, p. 177. Pl. XX. a.) and recently (under the name of *Abatus cavernosus*) in the »Panamic Deep Sea Echini» (p. 211. Pl. 99), and also LOVÉN has given some excellent figures of a young specimen of the same species (named *Abatus cavernosus*) in his memoir »On Pourtalesia» Pl. XIV. The corresponding stages of *A. cavernosus* agree very closely herewith, as might be expected on account of the near relation between these two species. The following stages, showing the development of the fasciole and the ambulacra, and, upon the whole, the transformation of the test from the embryo to the fullgrown Echinoid were hitherto unknown. I have thus thought it desirable to use this rare occasion for giving a full account of the changes undergone during growth by this species. — Upon the whole the development of *A. cavernosus* corresponds rather closely with that of *Brisaster fragilis* (comp. »Ingolf» Echinoidea. II. p. 111—114. Pl. XIII), a fact of considerable importance for judging of the relationship of the genus *Abatus*.

It may first be stated that in one and the same marsupium may be found newly laid eggs, embryos with the spines just appearing and fully developed young ones, ready to leave the marsupium.

The first developmental stages: cleavage etc. I am unable to work out satisfactorily on the material before me; for this purpose a large material preserved specially for such research will be needed. Evidently the early development of this species will prove to be very interesting. On account of the large size of the eggs (a little over 1 mm. in diameter), there must necessarily be considerable differences from what obtains in Echinoids with small eggs and pelagic larvæ. As far as can be ascertained on the material in hand, the cleavage proceeds in the same way as that described by me for *Cucumaria glacialis* LJG., the nuclei lying scattered in the yolk and later on wandering towards the surface of the egg, the great yolk-mass remaining undivided. *

Regarding the development of the test, the first stage seen is that figured in Pl. XVIII. Figs. 3—4. The embryo at this stage measures 1.5 mm in length. It is seen that the development of the actinal skeletal plates precedes that of the abactinal. From the actinal side the calcareous plates spread out and, as it were, overgrow the yolk. The embryo in this stage is generally more or less irregular in shape on account of the mutual pressure in the marsupium; the actinal side, and so much of the abactinal side as is already covered by the coronal plates, has assumed the regular shape; but the apical skeleton still consists only of small isolated plates, which cannot overcome the irregular shape of the embryo. Contemporarily with the development of the apical system into a compact covering the embryo acquires its regular shape.

The explanation of the actinal skeleton (Pl. XVIII. Fig. 3) causes no difficulties. The primary interambulacral plates are seen to project adorally beyond the ambulacral plates; in the larger ambulacral plates, I. a, II. a, III. b etc., the inner pore is still not quite surrounded by the calcareous network. The sternum is already distinctly amphisternous, though, as might be expected, still of a primitive type. The spines have begun to appear, one especially is to be noticed on the outer end of each primary interambulacral plate, as also a small one on the oral end of each of them. — While the actinal skeleton is thus easily enough explained, the explanation of the abactinal skeleton causes very great difficulties. As seen on Pl. XVIII. Fig. 4 it still consists of a number of irregularly arranged plates of very different size, most of them quite small. Only of three of these plates can it be said with certainty which plates of the apical system they represent. The largest of them, on the right anterior side, is the madreporite; the one to the right outside this, lying over the terminal sucker, is evidently the right anterior ocular plate, and the larger plate to the left of the anterior end of the madreporite is the anterior ocular plate (III). Spines have not yet appeared on the abactinal side.

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* Zur Anatomie und Entwicklung der Cucumaria glacialis. Zeitschr. f. wiss. Zool. LVII, 1894, p. 721.

The next stage to be mentioned is that in which the fasciole has just made its appearance, the embryo measuring now 1.8—1.9 mm. in length, 1.6 mm. in breadth. The actinal skeleton differs from that in the foregoing stage only by the ambulacral plates having increased in size adorally so as to reach the inner edge of the primary interambulacral plates, the edge of the peristome being thus regular, nearly round; the inner, ambulacral pore of the plates I. a, II. a, III. b etc. is now quite enclosed by the plate. The abactinal skeleton, on the other hand, has undergone very important changes (Pl. XVII. Fig. 9). The anterior ambulacrum has already 3 pores and tubefeet in one series, 2 in the other, while the paired ambulacra have no tubefeet developed as yet, except the primary tentacle. The primary fasciole has appeared, as stated above, and inside it a pair of primary tubercles (spines) are seen in each interambulacrum, not larger than those outside the fasciole. Of much greater importance, however, are the changes seen in the apical system. The madreporite, representing the right anterior genital plate (2), is very large, but with only one pore; it joins the anal area, thus separating the two sides of the apical system, which is accordingly ethmolytic from the beginning. In the anal area a circle of small plates have appeared, and behind, in the median line, is seen a larger plate, which must evidently be identified as *the posterior genital plate* (5). It was found distinct in all specimens of a corresponding size examined, and it must accordingly be regarded as a constant feature, and one of the highest morphological value, meaning that the apical system is here typically endocyclic. There is no central (suranal) plate seen in this, or, indeed, in any of the stages examined; it seems then evident that this plate does not occur here at all. — Probably this will hold good for all the »Irregularia», as it appears to do also for the Diadematids, Echinothurids and Cidarids, and likewise for the Palæechinoids. The central plate thus seems to have been separately acquired by the Salenids and Echinids proper, which leads to the conclusion that the alleged homology between this plate and the dorsocentral plate of the Crinoids is false. Lovén's suggestion, that the small plates on the periproct are »the rudiments of the central ossicle and the costal 5» (On Pourtalesia p. 74. Pl. XIV. Fig. 164), seems unacceptable, resting, in fact, on no evidence at all, only on the a priori assumption that the central plate must be represented in some way. (Regarding the »costal» 5 see below). Still less acceptable appears his explanation of the madreporite of the Ethmolytic Spatangoids as being composed of genital (costal) 2, the central plate and genital (costal) 5 (On Pourtalesia p. 71). The existence of a separate genital 5 proves that the madreporite has not absorbed this plate, as it were; it has, upon the whole, nothing to do with this plate. Unfortunately, I am unable to state beyond doubt the ultimate fate of genital 5. There are only two alternatives, viz. that it may be resorbed and disappear totally, or that it may *remain as the posterior of the periproctal plates*. I think the latter alternative is the more probable, but I cannot give definite proof for it.

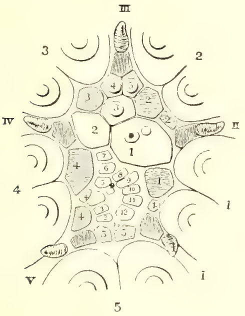


Fig. 15. Copy of the figure 308 of A. Agassiz' »Panamic Deep Sea Echini», representing the apical area of *Abatus cavernosus*, (*cordatus*) 1,9 mm.

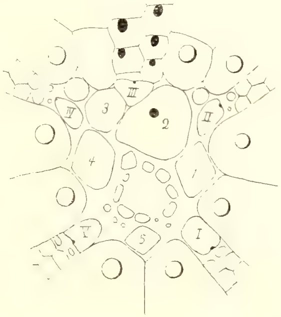
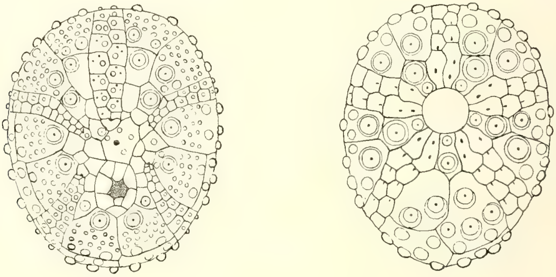


Fig. 16. Apical area of *Abatus cavernosus*, 1,9 mm. Simplified copy of Pl. XVII. Fig. 9. The genitals are numbered 1, 2, 3 etc., the oculars I, II, III etc.

A corresponding stage of the development of *Abatus cordatus* has been figured by Lovén (On Pourtalesia. Pl. XIV) and by A. Agassiz (Panamic Deep Sea Echini Pl. 99. Figs. 1—7, p. 213, figures 307—308) (under the name of *Abatus cavernosus*). While the explanation of the apical plates given by Lovén (Op. cit. Pl. XIV. Fig. 164 a) is evidently correct, as far as he has been able to trace the plates, the explanation of these plates given by Agassiz is evidently unacceptable, as is easily seen on comparing the figures 15 and 16, the former representing the figure 308 from the »Panamic Deep Sea Echini», the latter a simplified copy of the Pl. XVII.

Fig. 9. AGASSIZ does not give a detailed explanation of this or the other figures, and I am unable to grasp his meaning fully from the numbers put on the plates. But there can be no doubt of what is considered the Ocular III, it must be that with the tentacle; inside this plate are seen 3 smaller plates, two outer paired, and one inner single. What are these plates? In the figure 307 they are seen to be provided with pores; in the figure 308 these pores have metamorphosed into tubercles, but judging from Pl. 99. Fig. 7 they would much sooner represent tubefeet. This would mean that they represent the Ocular III and two ambulacrals, and the comparison with the figure 16 leaves no doubt that this is the true explanation. The alleged ocular plate outside must be incorrectly drawn, and likewise the odd tentacle has got a wrong place. When this has been made clear the identification of the rest of the plates is easy enough; it will be sufficient ro refer to the two figures.



17. 18.

Figs. 17—18. *Abatus cavernosus*, 2.5 mm. Abactinal (17) and actinal side (18).

Regarding the actinal side of the test in the figures quoted of the »Panamic Deep Sea Echini» I would only remark that Professor AGASSIZ' surprising statement of the sternum forming »almost a true meridosternum» (p. 212) is evidently due to a misconception. It is, as should be expected, a true amphisternum, the two sternal plates being quite equally developed in the anterior end; the fact that one is slightly longer than the other at the aboral end, a character well known in different types of amphisternum, especially the more primitive, is likewise only what should be expected. (Cf. »Ingolf» Echinoidea. II. p. 84.)

The next stage observed is that of the fully developed young, ready to leave the marsupium, 2.5 mm. in length * (Figs. 17—18). The most important change to be observed on the abactinal side is that the odd posterior interambulacrum has pushed its way forwards along the sides of the periproct, three small plates having developed here on either side. The periproct, in which the plate at the posterior edge, the supposed genital 5, is to be especially noticed, still directly joins the madreporite, which has as yet only one pore. In the odd anterior ambulacrum 4—5 pairs of pores have appeared, and they are already double, except the inner ones. In the paired ambulacra no pores have appeared as yet. The mouth has not yet been formed; some small plates have appeared in the actinal membrane. The peristome is round. The fasciole is still in the primitive condition, enclosing both the apical system and the periproct. On the madreporite some small tubercles have appeared which might well seem to represent the beginning of the transverse band of the fasciole. This is, however, not the case, as is easily seen by a careful comparison with the following stages. While the tubercles of the madreporite remain distinct until much later stages, the transverse band of the fasciole appears behind the madreporite, traversing the upper plates of the posterior interambulacrum (Fig. 19). The tubercles on the madreporite are also slightly larger than those of the fasciole, and the spines borne on them differ distinctly in structure from the clavulæ of the fasciole, being smooth and only slightly widened in the point, while the clavulæ are much widened in the point and thorny on the shaft. (In the grown specimens both kinds are thorny on the shaft.)

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* In a fragment of a large specimen, probably of *Abatas cavernosus*, from the Magellan Strait (the Hamburg Museum) I find the young ones in the marsupium considerably larger, 3.5 mm. in length. The transverse band of the fasciole has not yet appeared in these specimens.

In the Pl. XX. a. Fig. 9. of the »Challenger» Echinoidea is represented an exactly corresponding stage of a young *A. cordatus* (»*Hemiaster cavernosus*»); it is reproduced somewhat diagrammatically in the »Panamic Deep Sea Echini» Fig. 306, p. 212.* The original figure is in many respects inaccurate and does not give the limits of the plates; in the reproduction of the figure the limits of the plates have been introduced, but evidently without reexamination of the specimen — and the result has not been very satisfactory. The ambulacra are represented as having each one or two large pores; in reality the frontal ambulacrum has already 5 pairs of ambulacral plates with distinct, double pores inside the fasciole, while the paired ambulacra have no pores at all inside (or in) the fasciole; only the ocular pore and the terminal tentacle are large and distinct — but this pore is not represented in the quoted figure in the two left ambulacra. That the tubercles within the fasciole are represented too large — they do not exceed those outside the fasciole in size — is of minor importance. But the facts pointed out here bear evidence that this figure is quite a misconception, the original and the altered copy as well; it ought not to be taken into account any more in serious scientific discussions. — It may be objected that the figure represents *A. cordatus*, while my observations are made on *A. cavernosus*, and that the differences might thus be due to specific differences. This objection does not hold good, for two reasons: 1) it is extremely improbable that two so nearly related species as *A. cordatus* and *cavernosus* should prove so highly different in this early stage, and 2) I have examined a corresponding stage of *A. cordatus* and found it exactly agreeing with *A. cavernosus*.

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* In the »Challenger» Echinoidea p. 181 it is described as having the periproct »covered by a large plate having a small opening opposite to the left posterior ambulacrum». This is evidently due to a misconception, the madreporite having been taken for the anal area and vice versa. (Cf. Die Echinoiden d. deutschen Südpolar-Exped. p. 89.) In the reproduction of the figure in the »Panamic Deep Sea Echini» this error has been corrected.

Pedicellariæ are developed already in this stage, both globiferous, rostrate and tridentate, the latter both 2- and 3-valved; they are all of the same structure as in the grown specimens; the rostrate pedicellariæ are only comparatively very large. The disk of the tubefeet of the frontal ambulacrum is small, the rosette plates are not yet developed. The tubefeet around the mouth show the first indication of the terminal prolongations. The spicules are few and small.

The next stage, the youngest of the free-living specimens found in the material, is represented by specimens of 4 mm. length. There is thus a small gap here. Meantime the developmental processes, which have been going on while the specimens have grown from 2.5 mm. to 4 mm. length, are easily enough understood. There is a complete series of specimens of the following sizes. In Pl. IX are represented a series of figures of young specimens (4, 5, 5.5, 6, 6.5, 7, 8, 8.5, 9, 12, 16 and 18 mm.) showing the changes undergone by the test during growth. The tests have been cleaned and treated with alcohol-glycerine and show the limits of the plates upon the whole very clearly. It has, however, been thought necessary also to give some text-figures illustrating the minor features, which cannot be seen exactly in the phototypic plates, but which are necessary for gaining a clear conception of the growth changes of the species.

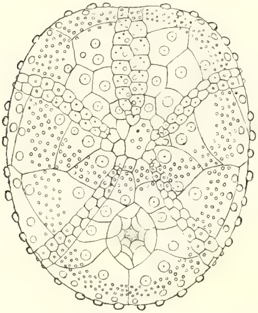
Fig. 19. *Abatus cavernosus.* 4 mm. Showing the transverse band of the fasciole.

In the specimens of 4 mm. an important change is to be noticed, viz. that the transverse branch of the fasciole has been developed (Fig. 19), the whole of the fascioles of the species having thus been formed, viz. the peripetalous fasciole (anterior part of the primary fasciole + the transverse band) and the latero-anal fasciole (the posterior part of the primary fasciole). The transverse band is seen to pass between the apical system and the periproct, traversing the two pairs of interambulacral plates which have meantime developed between the periproct and the madreporite. As growth goes on this transverse fasciole becomes stronger, but it keeps its position on these plates, being found also in the grown specimens on the second pair of interambulacral plates beyond the periproct. It is thus seen that the *fasciole does not alter its relations to the plates*, its apparent shifting of position being due to the development of new plates inside it. The same fact holds good for the periproct and the »latero-anal« fasciole, as the part of the primary fasciole behind the transverse band should be termed. It is thus not surprising that Professor AGASSIZ was unable to trace »the transfer of the anal opening to the exterior of the fasciole» (»Challenger» Echinoidea p. 181),* the reason being, not that the specimens were too young for showing it, as AGASSIZ supposes, but that it is not transferred at all; it retains its original position within the *primary*, (not the peripetalous) fasciole. — The latero-anal fasciole soon becomes less prominent and generally wholly disappears later on; already in a specimen of 8 mm. length I have found it quite rudimentary, but mostly it remains distinct until a size of about 20 mm. length. Sometimes it may also be distinct, especially the part below the periproct, in fullgrown specimens.

Regarding the development of the petals the following facts are to be noticed (Figs. 19—22). In the specimens of 4 mm. length (Fig. 19) there are 6 pairs of plates, with double pores, within the fasciole in the frontal ambulacrum. In the anterior lateral ambulacra 4—5 pairs of small plates have appeared inside the fasciole; they are perforated, but only with a single small pore each; those outside the fasciole are not perforated. In the posterior lateral ambulacra there are as yet only the ocular plates seen inside the fasciole. In the odd anterior ambulacrum the further development (Figs. 20—22) simply consists in the augmenting of the number of plates and in the plates becoming broader; this is done by growth mainly along the median edge of the plates, as must be concluded from the fact that the pores retain their position near the outer edge of the plates.

In the anterior lateral ambulacra the pores have become double in a specimen of 5 mm. length, and even in both the anterior and posterior series; on the other hand I find the pores in the anterior series single as yet in a specimen of 6 mm length. I suppose this difference is due to the sexual difference, the specimens with the earlier development of the pores being probably the females, in which the ambulacra have to reach a much larger size than the males. At a size of 8 mm. length the anterior ambulacra are already distinctly petaloid, with ca. 6 pairs of pores in

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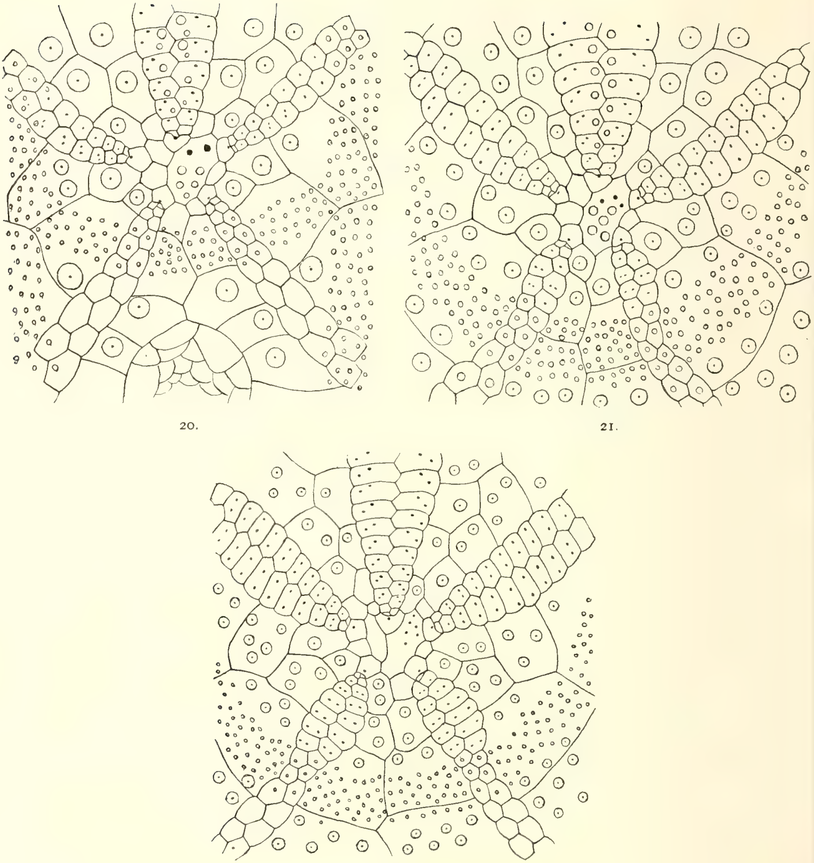
* In the place quoted Professor AGASSIZ says: »This fasciole, from its position, must undoubtedly be the peripetalous fasciole, as it agrees in position with the same fasciole in *Brissopsis*, though in the latter genus it does not enclose the anal opening. In the adult *Hemiaster* the anal opening is not thus surrounded, an additional example of the little value we can place upon the anal opening as a systematic character.» The evidences of the true morphological value of the primary fasciole given here and in the »Ingolf» Echinoidea II (p. 111—114) (*Brisaster fragilis*) show the remarks quoted to be erroneous.



Figs. 20—22. The apical system and adjoining part of the test of *Abatus cavernosus* of 6.5. 7.5 and 9 mm. length. — Resp. 20, 16 and 14 times magnified.

each series. — In the posterior lateral ambulacra the first, simple pores inside the petals appear in specimens of about 7 mm. length; at about 8 mm. length 2—3 pairs of double pores have been developed, and at about 9 mm. length they are already distinctly petaloid, with 4—5 pairs of pores in each series.

In the arrangement of the tubercles no regularity is seen; it should only be noticed that the rather prominent tubercle found on each of the 5 primary interambulacral plates round the peristome remains distinct till a rather late stage; that on the labrum may even be distinct in grown specimens.

The peristome is originally circular, the mouth opening being in its centre. As seen by the figures on Pl. IX the change in the shape of the peristome is produced mainly by the first plate of the odd posterior interambulacrum, the labrum, growing forwards, gradually covering the posterior part of the peristome and, at length, also the mouth opening. — AGASSIZ (Pan. Deep Sea Ech. p. 212) points out that in the young all the interambulacra are in contact with the peristome, »though in older specimens (Pl. 99. Fig. 8) the posterior lateral ambulacra are excluded from the actinostome». Apart from the lapsus calami, »ambulacra» for interambulacra, it may be pointed out 1) that in the figure quoted only the right posterior interambulacrum is shut out from the peristome, and 2) that this is no constant feature of the species; it seems to be more commonly the case that all the interambulacra remain in contact with the peristome, though only very narrowly, as in the left posterior interambulacrum in the figure given by AGASSIZ (Op. cit. Pl. 99. 8).

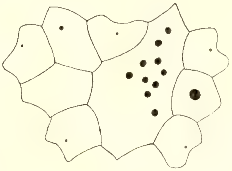


Fig. 23. Apical system of *Abatus cavernosus*, 18 mm. in length. $^{20}/_{1}$.

The pores of the madreporite do not increase in number until a rather late stage (comp. Figs. 19—22); in specimens of about 8 mm. length there may as yet be only a single pore, though, on the other hand, the second pore may appear somewhat earlier. — The first indications of the genital pores have been found in a specimen of 18 mm. length (Fig. 23).

Abatus Philippii LOVÉN.

Pl. XI, Figs. 6, 9—13. Pl. XIX, Fig. 47.

Abatus Philippii LOVÉN. 1871. Om Echinoideernas byggnad. Öfvers. Vet. Akad. Förh. N:o 8, p. 6. Fig. 1.
— — LOVÉN. 1874. Études sur les Échinoidées. Pl. XI, fig. 99. Pl. XXIX, figs. 188—190.
— — LOVÉN. 1883. On Pourtalesia, p. 73. Pl. VIII, Figs. 63, 77. Pl. X, Fig. 91.
Hemiaster — A. AGASSIZ. 1873. The Echini collected on the Hassler-Expedition. Bull. Mus. Comp. Zool. III. No. 8, p. 189.
— — A. AGASSIZ. 1874. Zoological Results of the Hassler Expedition. Illustr. Catal. Mus. Comp. Zool. VIII, p. 20. Pl. IV, Figs. 4—8.
Tripylus cavernosus BERNARD. 1895 Échinides . . .du Cap Horn. Bull. Mus. d'hist. nat. N:o 7. p. 2. (pro parte).
Non: *Hemiaster Philippii* WYV. THOMSON. 1877. The Atlantic II, p. 229—34 (= *A. cordatus*).

Lovén never gave a description of this species, the main character of which he found in the two genital pores. This character, however, is shown by Agassiz (»Hassler» Echini) to be unreliable, two or three genital pores occurring quite indifferently. As characters distinguishing the species from »*Hemiaster*» *australis* Agassiz points out, the »short posterior lateral ambulacral petals and its narrow peripetalous fasciole». Otherwise the males, on account of their shallow ambulacra, are taken to be only the younger stages, and the suggestion is made that likewise *australis* is only the young of *cavernosus*. — Later on, in the »Challenger» Echinoidea Agassiz is of opinion that *A. Philippii* is only a synonym of *cavernosus*.

Through the kindness of Professor Théel I have had occasion to examine the type specimens of Lovén and to compare them directly with my specimens; likewise Prof. Theel sent me some specimens identified by Lovén as *A. cavernosus*. It was evident enough that the only distinction between these specimens was that some of them have 2, others three genital pores; the former had been named *A. Philippii*, the latter *A. cavernosus*. Though Lovén himself has thus not had the right conception of his species *A. Philippii*, it seems to me that it is real enough, its main character being not the number of the genital pores, but the feature that *only the anterior paired petals are deepened in the female*, to which may be added the characters pointed out by Agassiz. It must, however, be conceded that quite reliable characters by which to distinguish the males of *Philippii* and *cavernosus* can scarcely be pointed out, so that it may sometimes be very difficult to decide whether some specimen is *cavernosus* or *Philippii*. (Perhaps such specimens may be hybrids.) In spite of this uncertainty regarding the males I think it right, on account of the very marked features of the females, to keep them as separate species; perhaps a larger material will prove *A. Philippii* to be only a variety of *cavernosus* — this, however, is of small importance. That it ought in any case to be kept as a separate type seems to me evident. — It may be thus described.

The test is generally rather flat and broad, the greatest width being at or a little before the middle; it narrows somewhat abruptly towards the posterior end. The posterior interambulacrum is generally somewhat keeled on the abactinal side, the highest point being somewhat behind the apical system, which is central or subcentral. The hind end of the test is a little prominent above, slightly concave below, whereas in *cavernosus* it is vertical. The petals of the female are sufficiently characterized by the peculiar feature, pointed out above, of only the anterior ones being deepened; the posterior ones are somewhat shorter. In the males they are comparatively a little longer than in *cavernosus;* the anterior ones are directed somewhat more sidewards, the posterior generally somewhat more backwards, the interambulacrum between them being slightly narrower than in *cavernosus;* it seems to be characteristic that the posterior petals are generally somewhat narrower than the anterior ones. — Generally there are only three large subanal tubefeet on each side, whereas there are generally 4—5 in *cavernosus:* this is, however, no quite reliable character either, as I find in a female specimen received from the Paris Museum (one of the specimens recorded by BERNARD, Op. cit., as *Tripylus cavernosus*) even 6 large subanal tubefeet. On the actinal side I do not find any character distinguishing the species from *cavernosus.* — The pedicellariæ do not afford very reliable distinguishing characters; only the tridentate differ somewhat from those of *cavernosus*, the larger ones being more slender and elongate than I have found them in that species (Pl. XIX. Fig. 47); in view of their great variability in *cavernosus* there can not, however, be laid much stress upon this feature. The smaller ones are as in *cavernosus;* the same holds good for the spicules.

The colour is white on one of LOVÉN's types and on two specimens in hand from the Hamburg Museum, but the specimen from Paris has the same brown colour as *cavernosus;* the white colour of the other specimens is thus evidently due to the preservation.

I have seen in all 7 specimens of this species, viz. two type specimens of LOVÉN, besides two specimens identified by LOVÉN as *A. cavernosus;* they came from »off La Plata»; further two specimens from the Hamburg Museum, from 38° S. 56° W. 52 fathoms and 43° S. 60° W. 56 fathoms, and one from the »Expédition du Cap Horn» (Baie Orange). The »Hassler» Expedition took several specimens along the Patagonian coast in 44—45 fathoms. It is not represented in the collections of the Swedish South Polar Expedition or the Fuegian Expedition.

The species thus appears to range from the La Plata to the Southern Extremity of South America; it is known with certainty from shallow water to 750 m.; the large depth 750 m. is based on the »Challenger» Ech. (St. 310). Though the specimens from this station are recorded as »*Hemiaster cavernosus*» it may be concluded that at least one of these specimens was really *A. Philippii* from the statement made by A. AGASSIZ (p. 184) that »one of the specimens from Station 310 combines the features of the two sexes in having nearly flush posterior ambulacral petals, while the anterior petals are almost as deeply sunken as in well-developed females of the same size». — That the specimens from the »Hassler» Expedition are really *A. Philippii* I think very probable, partly because AGASSIZ has had a type specimen from LOVÉN for comparison, partly because he expressly states that the posterior petals are »comparatively shallow»; also the figures seem to show that, though, it must be conceded, the figures 4 and 6, Pl. IV, show the posterior petals deeper than I have seen them in any of the specimens examined by me; but evidently they are considerably less deepened than the anterior ones, which distinguishes them from *cavernosus.*

Abatus Agassizii (Pfeffer).

Pl. X, Figs. 1, 3, 5, 9, 14. Pl. XIX, Fig. 40.

Hemiaster cavernosus A. Agassiz. 1872. Revision of Echini, p. 587. Pl. XXI. c. figs. 1—2.
— *australis* — — — — 586. — — 3.
— *cavernosus* G. Pfeffer. 1889. Zur Fauna von Süd-Georgien. Jahrb. d. Hamb. wiss. Anst. VI. p. 49.
— *Agassizii* Pfeffer. M. S.
— *cavernosus* Meissner. 1900. Echinoidea d. Hamb. Magalh. Sammelreise, p. 13—14.
? — *elongatus* Koehler. 1908. Astéries, Ophiures et Échinides de l'Expéd. antarct. nat. Écoss. Trans. R. Soc. Edinb. XLVI, p. 618. Pl. XVI, figs. 145—158.

This species differs in some respects markedly from *cavernosus* and *Philippii*, and it seems scarcely doubtful that it is a distinct species; in any case it must be kept separate from *cavernosus* or *Philippii*, even if it may ultimately prove that it deserves only to rank as a variety of *cavernosus*. — It seems highly probable that it was this species which Agassiz described and figured under the name of *Hemiaster cavernosus* and *australis* in the »Revision of Echini»; the photographic figures given there agree very closely with the typical *A. Agassizii*, as will be seen on comparing them with the figures given here. (On account of this De Loriol, on having the true *cavernosus* before him and seeing that it differed from *H. cavernosus* of the »Revision», described it as a new species, *H. gallegosensis*.) It further seems not improbable that the *H. elongatus* recently described by Koehler (Op. cit.) is identical with this species. Unfortunately the otherwise very elaborate description does not give any information of the subanal tubefeet; a communcaition from my side to the Scottish Oceanographical Laboratory in Edinburgh, where the material is preserved, has not been answered, so that I am unable to give information on the point in question, and I must therefore leave it undecided, whether *elongatus* is identical with *Agassizii* or a separate species.

The shape of the test (Pl. X. Figs. 5, 9) is upon the whole like that of *cordatus* (cf. Pl. XVIII. Figs. 2, 4, 16, 20 of »Die Echinoiden d. deutschen Südpolar-Exped.), it only affords one marked distinguishing feature, viz. in the odd anterior ambulacrum being flush with the test at the front end. On the abactinal side, inside the fasciole, it is slightly sunken. The posterior petals are as long as, or even longer than, the anterior ones; only in one specimen (from Stat. 33) I find the posterior petals slightly shorter than the anterior; the latter are directed more sidewards than is generally the case in *cavernosus*. The apical system is central, as is also the vertex, the test sloping from here towards both ends. The subanal tubefeet are rudimentary as in *cordatus*, only in the specimen from Stat. 33 one tubefoot is developed on one side. The peristome is somewhat larger than in the other species, sometimes even very large. Along the border of the labrum small spines and rather numerous pedicellariæ occur. — Otherwise I have nothing to add to the description given by AGASSIZ (Op. cit., under the name of *Hemiaster australis* and *cavernosus*).

The pedicellariæ do not afford very useful characters. Globiferous pedicellariæ I have not found, except in a fragment from South Georgia labelled *H. Agassizii* by Prof. PFEFFER; its somewhat deepened frontal ambulacrum and shorter posterior petals, however, make it very probable that it is not this species but *cavernosus;* the globiferous pedicellariæ end in two teeth, which would seem to show that it belongs to the var. *bidens.* (The posterior end of the test is not preserved so that it could not be seen whether the subanal tubefeet have been developed or not.) In case the *H. elongatus* is really a synonym of this species, the globiferous pedicellariæ are provided with two teeth as in *cavernosus* var. *bidens.* The rostrate pedicellariæ are of the usual form; the tridentate pedicellariæ, on the other hand, differ from those of the other species in having, viz. the larger ones, a well developed, spinulose meshwork or crests in the blade (Pl. XIX. Fig. 40). Also the shape of these larger pedicellariæ is somewhat different from what is found in the other species, the outer widened part being relatively larger. The smaller forms are as in the other species. — The spicules do not differ from those of the other species; this also holds good of the colour.

A young specimen (from South Georgia) of 12 mm. length (Pl. X. Figs. 1, 3) shows already all the characters of the species typically developed, being very different from specimens of *cavernosus* of a corresponding size (cf. Pl. IX. Figs. 7, 9). This decidedly points towards the specific distinctness of the present form. Even a specimen of 6 mm. length (likewise from South Georgia) looks rather different from *cavernosus* of a corresponding size — though it may, upon the whole, scarcely be possible to distinguish with certainty very young specimens of the different species of *Abatus.*

This species was taken by the Swedish South Polar Expedition at Station 19 (54°14′ S. 30°31′ W. 10—15 m. South Georgia), 5 specimens, and Station 33 (54°22′ S. 36°28′ W. 22 m. South Georgia), 1 specimen. The specimens from the Hamburg Museum likewise came from South Georgia. From the »Revision of Echini» it may be concluded that it occurs also at the Patagonian (and Chilian?) coast. It appears to be a strictly littoral species. — The *A. elongatus* was found at the South Orkneys.

Tripylus excavatus PHIL.

Pl. XI, Figs. 1, 14, 16. Pl. XII, Figs. 2, 4, 6, 9. Pl. XIX, Figs. 18, 34, 44.

Tripylus excavatus PHILIPPI. 1845. Beschreibung einiger neuen Echinodermen. Arch. f. Naturgesch. I. p. 344. Taf. XI, Fig. 1.
— — A. AGASSIZ. 1872. Revision of Echini, p. 169, 588. Pl. XXI. c, Fig. 4.
— — — 1874. »Hassler» Echinoidea, p. 22.

Tripylus excavatus MEISSNER. 1896. Die von Herrn Dr. Plate aus Chile heimgebrachten Seeigel. Arch. f. Naturgesch. I, p. 89.
— — — 1900. Echinoiden d. Hamburger Magalh. Sammelreise, p. 14.

Some other less important literary references are given in the two papers quoted by Dr. MEISSNER.

To the descriptions given by PHILIPPI and AGASSIZ I have to add only a few remarks.

The most important feature, the only thing, in my opinion, which justifies making this species the type of a distinct genus, is found in the anterior paired ambulacra. The petaloid condition does not continue down to the fasciole, the last 4—5 ambulacral plates having only small pores; as these plates are about twice as high as those above, the non-petaloid part of the ambulacrum inside the fasciole becomes about one third of the whole length of the petal. This feature has not been mentioned by either PHILIPPI or AGASSIZ, but in PHILIPPI's figures 1. a and c (Pl. XI) it is distinctly seen that the deepened part of the petals ends at a considerable distance from the fasciole, and in the fragments of PHILIPPI's type specimen, which Professor LUDWIG has most liberally lent me for examination, I find the same feature very distinct. This characteristic feature is thus found equally developed in both sexes. (The specimens at my disposal are males.) The posterior ambulacra are petaloid in their whole length. — Through the character described this species is at once distinguished from the different species of *Abatus*, with which it otherwise agrees in the prominent feature of the petals of the female being developed into deep marsupia. The same character distinguishes it from *Tripylaster Philippii*, with which it agrees in the distinctness of the latero-anal fasciole, the central position of the apical system and the small spines and tubercles. — One is also reminded of *Agassizia* by this feature of the anterior petals, and it can scarcely be doubted that this latter genus is really nearly related to the *Brisaster-Abatus* group. (That both *Brisaster* and *Abatus* pass through an »*Agassizia*»-stage is well worth remembering in this connection.) *Tr. excavatus* was, indeed, referred to the genus *Agassizia* by AGASSIZ & DESOR in their »Catalogue raisonné des Échinides».

As seems to be very often the case among the Irregular Echini, the right anterior side of the test projects somewhat before the left; this holds good for all the specimens in hand.

Of the odd anterior ambulacrum PHILIPPI says that it has »jederseits eine Reihe dicht gedrängter Porenpaare, welche, wie gewöhnlich, weit kleiner sind als die Poren der paarigen Ambulakra, und sich nach unten zu in eine Reihe einfacher Poren verwandeln, die sich zum Munde fortsetzt». Contrary to this statement I find the pores of the frontal ambulacrum rather distantly placed, much less closely than in the *Abatus*-species; especially towards the fasciole the plates become comparatively high and the pores accordingly distant. This feature I find likewise distinct in the type specimen. — The tubefeet of the odd anterior ambulacrum are, in accordance with the size and distance of the pores, very small and distant. The sucking disk is very little developed, the rosette-plates very small, not elongate. The spicules are small irregular rods, very few in number; they are found only just below the disk. The anal tubefeet are quite rudimentary, their pores being simple. The labrum ends off the middle of the first adjoining ambulacral plates. The latero-anal fasciole passes over the 11th—12th ambulacral plate. The spines are rather short and more delicate than in *Abatus;* they form a short, but distinct tuft on either side of the posterior end of the actinal side.

The pedicellariæ are very like those of *Abatus*. Globiferous pedicellariæ have not been found; if they occur at all, they will probably be found to be very like those of *Abatus*, as is the case with the rostrate pedicellariæ. The tridentate pedicellariæ (Pl. XIX Figs. 18, 34, 44) are slightly different from those of *Abatus cavernosus*, being somewhat broader in the lower part of the blade; they may have a distinct median longitudinal keel or be gently rounded; also the outer end of the blade may be somewhat pointed or simply rounded. Two-valved specimens occur, but rather seldom.

The colour of the denuded test is stated by AGASSIZ to be »grayish-pink», that of the spines light-green. In a very fine specimen from the Hamburg Museum the test and spines are quite white, the fasciole light brown; probably, however, the white colour is due to the preservation. In a dried specimen from Chili (the Berlin Museum) the spines are brownish, in a small space distinctly violet; the test of this specimen is also brownish, as in *A. cavernosus*.

This species was not taken by the Swedish South Polar Expedition and not by the Fuegian Expedition either. The specimens before me are from Chili (wrongly identified as »*Hemiaster cavernosus*» by MEISSNER) (»Die von Herrn Dr. Plate aus Chile heimgebrachten Seeigel» p. 87), from the Magellan Strait (R. Mulach) and from 49°35′ S. 64°43′ W. 62 fathoms. No other more definite statements are found in literature regarding the geographical and bathymetrical distribution of this species. (The identification of the small specimens from 37°42′ S. 56°20′ W. mentioned in the »Hassler» Echini is not beyond doubt.)

All the specimens (5) examined by me are males.

Schizaster (Tripylaster) Philippii (GRAY).

Pl. XII, Figs. 8, 10—11. Pl. XIX, Figs. 5, 7, 15—16, 21, 31, 48—49.

Tripylus Philippii GRAY. 1851. Description of some new genera and species of Spatangidæ in the British Museum. Ann. Mag. Nat. Hist. 2 Ser. VII, p. 132.

— — GRAY. 1855. Catalogue of the Recent Echinida of the Brit. Museum. I. Echinida Irregularia, p. 59. Pl. V. 1.

Schizaster — A. AGASSIZ. 1872—73. Revision of Echini, p. 158, 612. Pl. XXVI, Figs. 40—41.

— — STUDER. 1880. Übersicht d. »Gazelle» Echinoiden. Mon. Ber. d. Berlin Akad., p. 884.

— — MEISSNER. 1896. Die von Dr. Plate aus Chile heimgebrachten Seeigel. Arch. f. Naturgesch. I, p. 89.

— — MEISSNER. 1900. Die Echinoiden d. Hamburger Magalh. Sammelreise, p. 15.

— — DÖDERLEIN. 1906. Die Echinoiden d. deutschen Tiefsee-Exped., p. 252. Taf. L, Fig. 4.

Schizaster (*Tripylaster*) *Philippii* TH. MORTENSEN. 1907. »Ingolf» Echinoidea II, p. 122, 123.

Non: *Schizaster Philippii* A. AGASSIZ. 1904. Panamic Deep Sea Echini, p. 206. Figs. 297 a, 298. (These figures are reproduced from LOVÉN'S »Études« Pl. XI, Fig. 99, which represents *Abatus Philippii* LOV. and has nothing to do with *Schizaster Philippii* GRAY.)

Some other less important literary references are given in the papers quoted by Dr. MEISSNER.

To the previous descriptions the following remarks should be added.

The abactinal side of the test is gently sloping from the middle towards both ends. The actinal plastron is somewhat arched. The posterior prolongation of the labrum is short, ending off the first adjoining ambulacral plate. The interporiferous space of the odd ambulacrum is stated by AGASSIZ to be »quite narrow», which cannot be said very appropriately; the pores are placed close to the edges of the ambulacrum. The tubefeet of the anterior ambulacrum have a well developed sucking disk with rather long rosette plates. There are four well developed subanal tubefeet, the first of them occurring on the 7th ambulacral plate. The spicules of the tubefeet are not very numerous, small, irregular, branched rods. The latero-anal fasciole passes over the 12th plate of the posterior ambulacra. The spines are upon the whole short and fine, as in *Brisaster fragilis*, those on the posterior end of the actinal side do not form distinct tufts.

The pedicellariæ are of the globiferous, rostrate, tridentate and triphyllous types. The tridentate and rostrate have been figured by AGASSIZ in »Revision of Echini» Pl. XXVI, Figs. 40—41, while all four types have been figured by DÖDERLEIN (Op. cit.). A few additional remarks and also a few figures still seem to me not superfluous. — The globiferous pedicellariæ (Pl. XIX Figs. 31, 48) are of the same structure as in *Schizaster*, with an interior glandular cavity. As stated by DÖDERLEIN the terminal opening is surrounded by 3—4 teeth; generally there are four, but sometimes there may even be only the two. The basal part is rather narrow, the sides somewhat reenteringly curved. The muscles from the head are fastened on a little swelling some distance below the upper end of the stalk; the thick skin covering the valves continues some way down on the stalk (Pl. XIX Fig. 48). The rostrate pedicellariæ (Pl. XIX Figs. 16, 21) are of the *Brisaster*-type, very coarse, the blade short, somewhat widening towards the point and ending in about 10—14 rather coarse teeth.* The basal part is broad, the sides may be somewhat reenteringly curved. The neck is very short or not at all developed. The tridentate pedicellariæ (Pl. XIX Figs. 7, 49) are elongate, narrowed in the lower part, about half the length of the blade or a little more in the larger, comparatively less in the smaller ones; the outer part is spoonshaped widened, the two parts being rather sharply limited. These pedicellariæ reach a size of up to 1 mm. length of head. The neck is well developed. Quite small ones have the blade simply leafshaped, differing from the triphyllous pedicellariæ only in being more elongate, while in the latter the blade is almost round. Another slightly different form of tridentate pedicellariæ (Pl. XIX Fig. 15) has the outer widened part of the blade somewhat more coarsely serrate in the edge; it is, however, not very sharply distinguishable from the other form. — The sphæridiæ are smooth, but rather much grooved in the point.

The colour seems to be violet; at least there are traces of this colour on the specimens before me.

The Swedish South Polar Expedition has taken two specimens of this species at Station 2 (37°50′ S. 56°11′ W. 100 m. Coast of North Argentina); the Fuegian Expedition has taken some (broken) specimens at Puerto Condor (54° S. 70°8′ W.). Its geographical distribution, as hitherto known, is along the South American Coast, from the La Plata on the Atlantic to Calbuco on the Pacific side; it is not known from greater depths than about 100 m. — According to MEISSNER (Hamb. Magalh. Sammelreise) it also occurs at Fernando Po (Gulf of Guinea). That this statement rests on a wrong identification is certain. I have examined the specimen on which the statement is founded, and find it to be probably *S. Edwardsi* Cotteau. It is a young specimen and not very perfectly preserved, the identification is therefore not beyond doubt; but it is certain that it belongs to the high forms, *Schizaster* s. str., and has nothing to do with *Sch. Philippii.*

Regarding the affinities of *Sch.* (*Tripylaster*) *Philippii* I may refer to what has been said above (p. 68) and to the »Ingolf» Echinoidea II. p. 121—122.

Amphipneustes Lorioli KOEHLER.

Pl. XI, Figs. 17, 19. Pl. XIX, Figs. 1—2, 6, 10—12, 17, 22, 26.

Amphipneustes Lorioli KOEHLER. 1901. Résultats du Voyage du S. Y. »Belgica» en 1897—1899. Zoologie. Échinides et Ophiures, p. 12. Pls. II. Fig. 12, V. Fig. 37, VI. Figs. 42—43.

One specimen of this very interesting Echinoid was taken by the Swedish South Polar Expedition at Station 11 (65°19′ S. 56°48′ W. 400 m.; Graham Region). It answers, upon the whole, very well to the careful and accurate description given by KOEHLER; but, since Professor KOEHLER had likewise only a single specimen at his disposal, it is not surprising that I have some additional information to give. In Pl. XI Figs. 17, 19 are given photographic representations of the specimen, which seem to me not superfluous, especially in view of the several minor differences from the type, as figured by KOEHLER.

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* DÖDERLEIN (loc. cit.) describes these pedicellariæ as having the outer edge »schwach gezähnelt», which does not appear to me very appropriate, at least not for the larger samples.

The shape of the test is as in the type specimen, excepting that it is somewhat lower (length 48 mm., breadth 43 mm., height 29 mm.). The vertex is central. The apical system differs rather much from that of the type specimen, as figured by KOEHLER (Op. cit. Pl. VI Fig. 43). Only three genital pores are developed, the right anterior one is wanting, while it is developed in the type specimen. In the figure quoted the madreporic plate is represented as being separated from the right anterior genital plate by a transverse line; in the text nothing is said of this very unusual feature, which — as it cannot be supposed to be an error in the figure, it being expressly stated that the plates of the apical system are very distinct — I would suggest to be an abnormality. In any case the present specimen shows the usual condition, the madreporic plate being the posterior prolongation of the right anterior genital plate (Fig. 24). — The fact that such a case is also met with in *Amphipn. Koehleri* (comp. below, p. 98 Fig. 28) should be mentioned on this occasion; there it is evidently an abnormality.

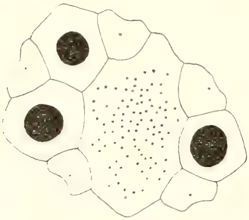

Fig. 24. Apical system of *Amphipneustes Lorioli;* the tubercles are omitted. $^8/_1$.

The ambulacra correspond to those of the type specimen, the number of the plates only being slightly smaller, in accordance with the smaller size of the specimen. Regarding the interambulacra it should be noticed that the plates are not elevated in the middle, as is the case in the type specimen. In the structure of the actinal plastron I find some noteworthy differences from what is seen in the type specimen, as represented by KOEHLER (Op. cit. Pl. V Fig. 37). The labrum is there shown to reach the fourth ambulacral plate, and the sternum is undivided, the plastron thus being meridosternous. In the specimen before me the labrum ends off the third ambulacral plate, and only the second ambulacral plate is quite short (Fig. 25), while in the type specimen the 3—4 inner ambulacral plates are represented as being quite short. The sternum consists of two plates, after the usual amphisternous type (Fig. 25); the suture between these two plates is, however, difficult to trace, and can only be seen with certainty after treating the specimen with alcohol-glycerin. I cannot doubt that this suture is really present also in the type specimen; a variation from the amphisternous to the meridosternous type, even in one and the same species, is, I think, impossible.

— In the type specimen all the paired interambulacra are excluded from the peristome, as shown in the figure quoted (Pl. V. 37); in the present specimen this is the case with interambulacrum 1., not with 2.; those of the other side I have not denuded, so I cannot state how it is with them. — The spines of the plastron were all broken, so that I cannot, any more than KOEHLER, give definite information of their shape; judging from some spines preserved in most of their length, the point is probably only slightly widened.

KOEHLER has pointed out the most interesting feature that the odd anterior ambulacrum is of almost the same shape as the paired petals, and that the pores are developed in the same way in all of them. It is in accordance with this fact that the tubefeet are also developed in the same way; the abactinal tubefeet of the anterior ambulacrum have no sucking disk and no rosette plates, as is, otherwise, generally the case; they are sack-shaped gills without spicules, quite like the tubefeet of the paired petals. There are no distinct subanal tubefeet. In the tubefeet at the peristome some few irregular rods or fenestrated plates are found below the disk; the supporting rods of their filaments are simple, not thickened.

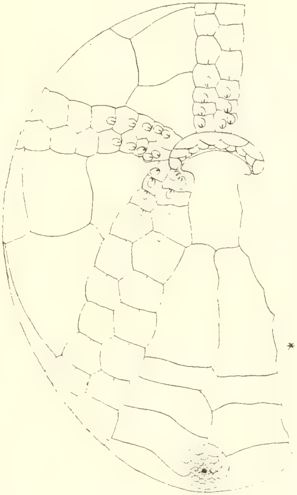

Fig. 25. Actinal skeleton, left side, of *Amphipn. Lorioli*. On the right side the outline is somewhat uncertain in the part from the mark * to the posterior edge; the same is the case with the hindmost right epiproctal plate and with the plates on the right half of the peristome, these parts not having been denuded. The plates on the periproct were not drawn with camera. $^{3}/_{1}$.

KOEHLER has found only one kind of pedicellariæ, viz. the interesting two-valved form figured in Pl. II. Fig. 12 (Op. cit.). I have likewise found this form, which evidently represents the tridentate pedicellariæ, in great numbers and different sizes, from quite small to 0.8 length of head (Pl. XIX Figs. 1—2, 6, 11, 22, 26). The valves are narrow, curved, the blade being a closed tube, only with a short slit downwards from the outer, slightly widened, part, where the valves join; in the small ones the blade is open in the whole length. There is no apophysis, a very interesting feature, not occurring in the bivalve pedicellariæ of *Abatus*. The neck is well developed; the stalk is rather compact, without distinct widening above; there is a more or less developed »milled ring» below. — Besides this form I have also found globiferous and rostrate pedicellariæ. Only one specimen of globiferous pedicellariæ was found, and even a rather badly preserved one; it is, however, to be seen that it is of the same structure as that described below (p. 97) of *A. Koehleri*, only the valves have in addition to the two large teeth in the point one or two shorter teeth. Probably this is only an abnormality (also in *A. Koehleri* the globiferous pedicellariæ have sometimes abnormally three teeth in the point), so that the typical form will prove to be like that of *A. Kohleri*. A thick skin covers the head and the upper end of the stalk as in *A. Koehleri*. — The rostrate pedicellariæ (Pl. XIX Figs. 12, 17) are threevalved, rather small, with the neck undeveloped (or indistinct, in any case in the samples seen by me); the stalk is compact, without distinct widening above or below. The whole pedicellaria is invested in a rather thick skin. The blade is narrow, open, the outer part, where the valves join, spoonshaped widened, with finely serrate edge; in the lower part of the blade the edge is generally smooth; the basal part rather narrow. — The sphæridiæ are elongate, irregularly rugose (Pl. XIX Fig. 10).

To judge from the following species, both the type specimen of *A. Lorioli* and the present specimen are males. It must, however, be conceded that the genital pores are somewhat large for a male; and as in *Abatus* one species, *A. Philippii*, has only the anterior petals transformed into marsupia, whereas the other species have both anterior and posterior petals thus transformed, it may well seem possible that in *Amphipneustes* one species has both pairs of petals transformed into marsupia, while the other species has none of the petals thus transformed; this species would then be non-viviparous. But further material is necessary for settling this question.

Amphipneustes Koehleri MRTSN.

Pl. XI, Figs. 2—5, 7, 8, 15, 18. Pl. XII, Figs. 1, 3, 5, 7. Pl. XVII, Figs. 10—11. Pl. XVIII, Figs. 1—2. Pl. XIX, Figs. 3—4, 8—9, 13—14, 19—20, 23—25, 27.

Amphipneustes Koehleri TH. MORTENSEN. 1905. Some new species of Echinoidea. Vidensk. Medd. fra Naturh. Foren. Köbenhavn, p. 243.

Among the Echini collected by the Swedish South Polar Expedition this new species of *Amphipneustes*, of which a short preliminary description was published in 1905, is especially interesting. Fortunately it is rather well represented, both fullgrown specimens, males and females, and young ones being present. The most interesting feature of this species is that the petals of the female are transformed into marsupia, in which the eggs and young are reared, exactly in the same manner as in *Abatus cavernosus*, with which it has also in general some resemblance; it is, however, at once distinguished from the *Abatus* species through the lack of the peripetalous fasciole and by its deep anterior abactinal ambulacrum. — I have named this species in honour of my friend, Professor KOEHLER, the author of the genus *Amphipneustes*.

The test (Pl. XI Figs. 3, 5, 7, 8, 15, 18) is low, as seen by the following measurements:

♂ Length 38 mm. Breadth 36.5 mm. Height 22 mm.
♀ » 31 » » 29 » » 18 »

The apical system is central or slightly anterior, somewhat sunken. The interambulacra form somewhat swollen ridges at the top; the sides are sloping gradually towards the edge, which is broadly rounded. The outline of the test, with the spines preserved (Pl. XII Figs. 3, 5, 7), is oval, as seen from above; when denuded it is seen to be somewhat truncated at both ends, even a little reenteringly curved at the posterior end. The lower side is flat, only the actinal plastron is distinctly elevated.

The ambulacra agree with those of *A. Lorioli* in the feature of the anterior ambulacrum being nearly as petaloid as the paired ambulacra, with the pores large and arranged in a similar way. — In the male (Pl. XI Figs. 3, 7, 8) the ambulacra are rather deeply sunken, especially the interporiferous part, the median suture lying deepest. The petaloid part of the ambulacra is rather distinct from the non-petaloid part, in spite of the lack of a fasciole. In the male there are in the anterior paired petals 13—14 plates with large pores in each series (the inner, not yet fully developed plates included), in the odd anterior and the posterior paired petals 12—13 plates with large pores in each series; all the petals are thus of nearly the same length. From the 13th—15th plate the pores are small and simple, and from there the ambulacra, also the anterior, are flush with the test. The pores in each pair are not widely separated, equally large, round; they are placed almost in the middle of the plate, a little more outwards, the outer pore a little lower than the inner one. The petaloid plates are naked in the inner part, set with miliary grains outside the pores; the non-petaloid plates are covered with irregularly placed large and smaller tubercles in the same way as in the interambulacral plates. There is no distinct series of larger tubercles along the edges of the anterior ambulacrum. The non-petaloid part of the anterior ambulacrum is a little narrower than the petaloid part, no widening occurring at the end of the petals as is the case in *A. Lorioli;* only in the posterior ambulacra there is a slight widening below the petaloid part. The non-petaloid plates are slightly higher than the petaloid. On the actinal side the ambulacral plates are almost naked, only with some scattered miliary tubercles. — The female differs from the male in having the paired petals deepened and transformed into marsupia (Pl. XI Figs. 5, 15) as in *Abatus;* only 12 plates are included in the deepened part.

The interambulacra form rather swollen ridges between the petals, but the single plates are not elevated in the middle. They are closely covered by uniform, rather coarse tubercles, between which numerous miliary tubercles are found. On the actinal side the primary tubercles are somewhat larger. The labrum is very prominent; it reaches backwards to the middle of the second ambulacral plate; in one specimen (male), however, the first adjoining ambulacral plate of ambulacrum I is very elongate, and the labrum does not reach beyond it. In this specimen the right sternal plate is the largest, the suture between the two sternal plates continuing into the suture between the first and second plate of the inner series of the left ambulacrum (I). The plastron is rather narrow, though less so than in *A. Lorioli;* the suture between the two sternal plates is distinct.

The apical system (Figs. 26—27) is like that of *A. Lorioli* (the specimen in this collection); the madreporic plate separates the posterior genital and ocular plates, but does not reach beyond the posterior ocular plates. Only three genital pores are developed, the right anterior one is wanting; they are small in the male, rather large in the female.

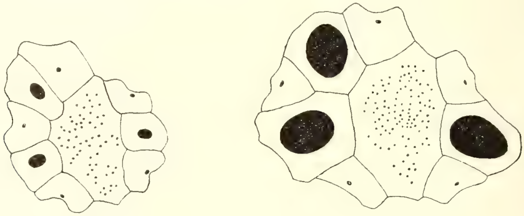

Fig. 26. Fig. 27.

Figs. 26—27. Apical system of *Amphipn. Koehleri*, male (26) and female (27). $^{8}/_{1}$.

A most conspicuous difference from *A. Lorioli* is found in the position of the periproct; it is placed on the posterior, vertical end of the test, so that it cannot be seen from the actinal side; it is more or less sunken. It is somewhat variable as to size and form, but, upon the whole, it may be said to be a little elongated, pointed in one or both ends; it is covered by small plates in the usual way.

The peristomial region is somewhat sunken; the first interambulacral plates not excluded from the peristome, which latteris of the usual size. The plates of the peristome are covered with miliary tubercles carrying pedicellariæ.

The spines are rather long and coarse, of uniform length, covering the petals and the apical system completely; those of the actinal side are a little longer, those of the plastron are flattened at the point but not widened. The miliary spines are slightly curved and clubshaped. The colour of the spines is brown, as is upon the whole the colour of the specimens as preserved in alcohol.

The tubefeet of the odd anterior ambulacrum are like those of the paired petals, sack-shaped gills, generally without spicules and without sucking disk or rosette plates.

Those below the petaloid part contain numerous spicules. The subanal tubefeet are rudimentary. In the tubefeet round the peristome the spicules are richly developed; they have the form of slender, slightly branched rods (Pl. XIX. Fig. 9). The rods supporting the filaments of these tubefeet are somewhat thick, but otherwise of the common simple structure.

The pedicellariæ are represented by three forms, viz. globiferous, rostrate and tridentate. The globiferous pedicellariæ (Pl. XIX. Figs. 3, 14, 20, 24) are generally very conspicuous, longstalked and with the head and the upper end of the stalk enclosed in a thick, probably glandular, coat. The valves end in two (seldom three) long teeth, gently curved at their base. The blade is narrow, with a long slit in the outer half, the lower part being a closed tube; its lumen continues some way down into the basal part. There is no neck; the stalk has a little swelling, where the muscles from the head are fastened, otherwise without widenings; it is of rather compact structure. This form of pedicellariæ is especially numerous along the petals. (In *Abatus cavernosus* var. *bidens* a quite similar form of globiferous pedicellariæ is found; cf. above p. 73, Pl. XIX. Figs. 32, 39.) — The rostrate pedicellariæ (Pl. XIX. Fig. 19) are very like those of *Abatus;* they are rather small, only ca. 0.2—3 mm. length of head. The tridentate pedicellariæ (Pl XIX. Figs. 13, 23, 25, 27) are three-valved, seldom two-valved; they reach a rather large size, up to 0.8 mm. length of head. The valves join only in the outer part, in about one third of the length of the blade; below they are widely apart. The outer part of the blade is widened, with finely serrate edges, the lower part is narrow, forming a closed tube below, with a broad slit continuing down from the widened part. The border between the two parts of the blade is sharply marked, the side edges being bent inwards over the blade and making rather sharp corners. The edges of the lower part of the blade are smooth, as are also the edges of the basal part and the apophysis. The neck is well developed, except on the largest specimens, where it may be almost wanting. The stalk is compact, with no distinct widenings. In the smaller tridentate pedicellariæ the narrow part of the blade becomes gradually shorter, and the quite small ones are simply leafshaped (Pl. XIX. Fig. 8). These latter may equally well be termed triphyllous pedicellariæ. — The sphæridiæ are round, rather much grooved (Pl. XIX. Fig. 4).

As stated above, the females have their petals transformed into marsupia, and, fortunately, the embryos were also found in the marsupia. As in *Abatus cavernosus*, I have found both eggs and large embryos, almost fully developed, in the same marsupium; in one I counted 7 eggs and 10 embryos, in another marsupium 11 eggs and 6 embryos. The eggs are yellow, evidently very rich in yolk, 1 mm. in diameter. Most of the embryos were about 2 mm. long, a few of them a little smaller and younger. The largest specimens from the marsupium correspond very nearly to the stage of *Abatus cavernosus* described above (p. 76 Pl. XVII. Fig. 9); the apical system is not quite so far on in its development, the anal plates have only just begun to appear; the genital plate 5 is distinct. Upon the whole it corresponds closely to that of *A. cavernosus*. Both mouth and anus are closed as yet. The terminal suckers are rather conspicuous. There is no trace of a peripetalous fasciole, and, since in *Abatus cavernosus* the fasciole is already distinct in specimens of a corresponding stage, it seems evident that a fasciole is never developed in this form. — It is, however, desirable that somewhat larger young ones should be examined for settling this important question definitely. It can scarcely be doubted that the further development is quite in accordance with that of *A. cavernosus*, with the exception alone of the absence of a fasciole. — Pedicellariæ have not appeared as yet in these young specimens.

The specimen next in size is 7.5 mm. long, 7 mm. broad and 4.5 mm. high (Pl. XI. Figs. 2, 4), its shape being thus, upon the whole, already like that of the grown specimens. The periproct has almost its definite place, only slightly more to the abactinal side. The ambulacra are as yet simple, without any indication of the later petaloid condition; the pores are single. The apical system (Fig. 28) is interesting in showing the same feature as the type specimen of *A. Lorioli*, viz. the madreporite being separated from the right anterior genital plate by a transverse line, resembling thus a real central plate — though I do not mean to maintain its homology with the central (suranal) plate of *Salenia*, *Echinus* etc.; it reaches somewhat beyond the posterior ocular plates, even a little more so than in the grown specimens (cf. Figs. 26—27). Also on the left side a small plate appears to have been separated from the madreporite, lying close to the left posterior genital plate — or it may be the latter plate which has been abnormally divided. There is one pore in the madreporite and another in the right anterior genital plate. Genital pores are not yet developed. The peristome is as yet almost quite embryonal, the labrum scarcely beginning to project over it. The posterior end of the labrum lies off the end of the first adjoining ambulacral plate (Pl. XI. Fig. 4).

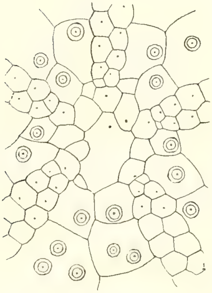

Fig. 28. Abactinal plates of *Amphipn. Koehleri*, 7.5 mm. 13.5/1.

In a specimen of 11 mm. length the ambulacra have become somewhat petaloid in another specimen, 12.5 mm. long, they are more distinctly petaloid, as might be expected. In this specimen the labrum does not yet project over the mouth; its hind end is off the second ambulacral plate. Genital pores have not yet appeared. The globiferous pedicellariæ are very conspicuous, as seen in the figure (Pl. XII. Fig. 1).

This interesting species was taken by the Swedish South Polar Expedition at Station 17 (53°34′ S. 43°23′ W. 160 m., Shag Rock Bank), 2 fullgrown female specimens and 3 young specimens, and Station 22 (54°17′ S. 36°28′ W. 75 m., South Georgia), 4 fullgrown male specimens and one young specimen.

KOEHLER, in discussing the relations of the genus *Amphipneustes*, comes to the result that it is nearest related to *Palæopneustes*. It certainly must be conceded that *A. Lorioli* has a very great resemblance to *Palæopneustes cristatus* A. AG. On the other hand, the new species of *Amphipneustes* here described shows beyond doubt many relations to *Abatus*, with which genus it agrees in every essential respect, except in the lack of fascioles. It would thus seem that *Amphipneustes* forms a connecting link between the genera *Palæopneustes* and *Abatus*. However, the affinity seems to be more towards *Abatus*. It is a noteworthy fact that the pedicellariæ of *Palæopneustes* * differ considerably from those of *Amphipneustes*, which latter genus, on the other hand, resembles *Abatus* in the structure of the pedicellariæ. Unfortunately globiferous pedicellariæ have not been found in *Palæopneustes*. — I cannot, however, enter here on a more detailed discussion of the affinities of these genera, having not yet had the opportunity to study *Palæopneustes* more closely.

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* The pedicellariæ of *Palæopn. cristatus* have not been described in a more detailed manner; but I have had occasion to examine those of a specimen in the British Museum; it is especially a conspicuous difference from *Amphipneustes* that ophicephalous pedicellariæ are very numerous here, but also the tridentate pedicellariæ are of quite a different structure. Otherwise I think GREGORY was right in separating *P. hystrix* from the genus *Palæopneustes*, making it the type of his new genus *Archæopneustes*, leaving *P. cristatus* as the type and only recent species of *Palæopneustes*. (I. W. GREGORY, Archæopneustes abruptus a new genus and species of Echinid from the Oceanic series in Barbados. Qu. J. Geol. Soc. Vol. 48, 1892. p. 163.)

Zoogeographical remarks.

In the »Echinoiden der deutschen Südpolar-Expedition» (p. 92—105) a general account of the Zoogeography of the antarctic-subantarctic Echinoid-fauna is given, the main results being the following: The South American (Patagonian-Chilian) littoral region must be regarded as the centre of the whole antarctic-subantarctic region; a very great proportion of the Echinoids occurring in the Patagonian region are known from this region alone, while others are known also from the Antarctic region (*Arbacia Dufresnii*, *Sterechinus Neumayeri*, *Abatus cavernosus*(?) and *Austrocidaris canaliculata* (?)). This bears testimony of a former connection between South America and the Antarctic Continent; especially the occurrence of the viviparous genus *Abatus* in both these regions is conclusive evidence of such a connection, even if it be ultimately proved that the species *cavernosus* does not really occur at the antarctic coast. Further the Echinoids prove that the Kerguelen-group also belongs to the Patagonian region; the occurrence there of *Abatus cordatus*, very nearly related to the Patagonian species *Abatus cavernosus* and *A. Agassizii*, and of *Eurocidaris nutrix*, nearly related to the Patagonian *Austrocidaris canaliculata* points to the existence of a former land or shallow water connection between Kerguelen and South America; especially the *Abatus* species, being viviparous and a littoral species, cannot possibly have come to Kerguelen over the vast deep sea now separating this group of islands from South America. Also a transportation on algæ,[1] which might be possible for *Eurocidaris*, is excluded for this species.

To the Echinoid fauna of South Africa and New Zealand the Patagonian fauna has no relation whatever,[2] a fact in direct contradiction to the hypothesis of a former land connection between these regions, directly or indirectly (over the antarctic continent), as it may be concluded that such a land connection would have left its traces in the littoral fauna (as well as in the land fauna and flora) — or as IHERING says: »Identische Küstenspezies weisen auf ehemalige Zusammenhang der Küsten hin» (»Archhelenis und Archinotis» 1907, p. 185), a sentence which I can adopt with the modification, that such species should not have pelagic larvæ and not be capable of being transported on floating algæ.

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[1] I may recall the observation of *Protocentrotus angulosus* carried on floating algæ in the Atlantic recorded in the »Echinoiden d. deutschen Südpolar-Exped.» p. 61.

[2] The occurrence of a species of the genus *Notechinus* at New Zealand (Stewart Island) (cf. p. 40, Note) cannot give evidence for the supposed land connection with South America. The genus *Notechinus* is widely distributed in the subantarctic region, and has most probably pelagic larvæ, which may be transported by the currents. — I may here also recall the fact that the quite recent indication by RUDMOSE BROWN of the occurrence of »*Goniocidaris*» *canaliculata* at South Africa has proved to be erroneous, being due to a wrong determination (cf. p. 19, Note).

It is, of course, impossible from the study of the Echinoid fauna alone to prove anything about a connection between these regions in very remote periods, palæozoic or elder mesozoic. But it is possible to fix the period beyond which such a connection cannot have existed. It is to be noticed that such characteristic forms as *Protocentrotus*, *Spatangus* and *Echinocardium* are not known from South America, recent or fossil. Since the two latter, at least, are well developed in the Eocene, it seems justifiable to conclude that a connection between South America, South Africa and New Zealand cannot have continued beyond the Cretaceous period. It is likewise to be concluded from the characteristic Echinoid family, the *Temnopleuridæ*, so richly developed in the Indo-Pacific region but totally wanting at the American coast, that the supposed connection between South America and the Australian region (Chili, New Guinea, New Zealand) cannot either have continued beyond the Cretaceous period, since the Temnopleurids are already well developed in the Eocene period.

In addition to the above zoogeographical remarks on the South American Echinoid fauna I would take the occasion here to give some further notes on a few zoogeographical questions, pointing out what may be concluded from the littoral Echinoid fauna of this region, whose importance in zoogeography has been made so evident especially through the researches of Professor H. v. IHERING.

It should first be pointed out that the very great percentage of endemic forms among the Echinoids of the Patagonian region is a fact perfectly in accordance with the »Archiplata»-theory of IHERING, according to which this part of South America is zoogeographically distinct from the more northern parts, »Archiguiana» and »Archibrasil», which latter are maintained to have been in connection with Africa in the Eocene period. The Echinoidea of the Patagonian region bear evidence of having developed here along the coasts of a large tract of land, isolated from Brasil. This isolation would be very perfectly realised through the land connection with Africa, as is sketched by IHERING in the map accompanying his book »Archhelenis und Archinotis». — It may be wondered why these species have not now passed over to the Brazilian coast, though these coasts are now in direct continuation. I would suggest that the reason is mainly the La Plata river, its immense mouth forming, with its fresh or brackish water, an almost insuperable hindrance for their wandering towards the North. According to IHERING the Rio Negro forms the boundary between

Archiplata and Archibrasil. As far as I am aware, none of the Patagonian Echinoids, however, are known to occur to the North of La Plata; but careful researches on the Echinoid fauna of this region are very much needed, and the present negative evidences are to be used with all reservation. It can only be stated that the facts known as yet point towards the conclusions drawn here. — The fact that *Encope emarginata* (Leske) occurs so far south as 51°35′ S. (Rio Gallegos) * indicates a wandering in the opposite direction, this species having its home in the West Indian region; it must then evidently have passed the La Plata river. (It has not been recorded as fossil from Patagonia, so far as I am aware.)

Another fact of importance is that some of the species do not pass the Southern Extremity of South America, being known only from the Pacific Coast (*Loxechinus albus*, not known outside the Magellan Strait on the Atlantic side) or only from the Atlantic Coast (*Austrocidaris canaliculata*, *spinulosa*, *Sterechinus Agassizii* (?), the *Abatus* species). This fact is in accordance with the theory of a former land connection between South America and the Antarctic Continent. (Also the littoral Mollusc-fauna shows the same interesting fact. Cf. IHERING, Archhelenis und Archinotis, p. 119.) That these species have not yet passed the Southern Extremity, though it does not appear why they could not live on the opposite coast, is, indeed, a remarkable fact bearing evidence that some species do not spread very rapidly. It would be highly interesting to find out the reason why the two species *Austrocidaris canaliculata* and *Loxechinus albus* have spread so slowly, while others, like *Arbacia Dufresnii* and *Notechinus magellanicus*, evidently have spread more quickly. (The *Abatus*-species may perhaps afford some parallel cases; but on account of the confusion previously reigning here, their range, as known at present, is scarcely quite reliable.

It will further be of great interest to see, whether the Echinoid fauna of South America bears any evidence for or against the Archhelenis theory, as set forth by IHERING. The fact of the Patagonian Echinoid fauna differing so markedly from the Brazilian fauna is certainly in favour of this theory; but there is another fact as decidedly speaking against it. If there had been in the Eocene epoch such a land connection as that sketched by IHERING, going from Southern Brazil to Africa, joining the recent African Coast from Guinea to the Cape, and even beyond the Cape to the Kerguelen group, there would doubtless be a distinct relation between the littoral fauna of South Africa and South America. This is, however, at least as regards the Echinoids, decidedly not the case, as I have shown in the »Echinoiden d. deutschen Südpolar-Expedition» (p. 98—100). The Echinoids, therefore, tend to show that there has not been such a direct connection between South Africa and South America after the Cretaceous period — and not between South Africa and the Kerguelen group either. That there has been a land connection between South America and Africa I do not venture to deny (though I must still maintain that the occurrence of identical species of Echinoderms, having pelagic larvæ, on both the African and the Brazilian-West Indian Coast is no proof of such a connection, as these larvæ certainly *can* pass from one coast to the other[1]; with the Mollusc larvæ the case seems different, as they would probably not be able to cross the Atlantic). But if such a land connection between Brazil and Africa, an Archhelenis-bridge, has existed, it seems evident from the Echinoid fauna of South Africa that this bridge cannot have been situated so far south along Africa as supposed by IHERING; and even if we suppose that it had gone only to Guinea, I do not see the reason, why we have no interrelation at all between these two faunas. The Echinoid fauna of South Africa, in fact, bears evidence against this region having ever, since the Cretaceous period, been in any connection with the South American region, either through an antarctic or through an »Archhelenis» land-bridge. — It is true that some species of Echinoids are recorded as occurring both in the Patagonian region of South America and at Africa, viz. *Austrocidaris canaliculata*, *Arbacia Dufresnii* and *Schizaster* (*Tripylaster*) *Philippii;* but these indications all rest on wrong identifications, as has been shown in the present work (p. 19, 31, 91).

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* DE LORIOL, Notes pour servir à l'étude des Échinodermes. 2 sér. II. 1904, p. 21.

How we are to reconcile the two contradictory statements: the Patagonian fauna bearing evidence for, the South African fauna against the land connection I will not try to explain. To suggest that the land-bridge had gone only to Guinea would certainly not give a satisfactory explanation; to suppose that the Atlantic continuation from »Archibrazil» had not reached Africa, would perhaps reconcile the two contradictory statements in a somewhat better way — but I cannot here enter on this great problem, I only want to indicate, what must be concluded from the study of the Echinoid faunas of these regions, the Echinoids being a group of animals whose importance for zoogeographical studies is certainly very great.

One thing I would still point out. It appears that the bathymetrical facts known from the Antarctic Ocean are in full accordance with the zoogeographical conclusions drawn from the study of the Echinoids of this region; the latter point towards a former connection between South America and the Kerguelen group, as also with the Antarctic Continent, while the Falkland Islands and South Georgia must be concluded to have been in much more recent connection with South America. The map of the Antarctic Sea constructed by BRUCE[2] indicates, in fact, a ridge connecting South America with the Kerguelen group and another ridge connecting it with the Antarctic Continent, while a great plateau with much shallower water is seen to connect the Falkland Islands and South Georgia with South America. Whereas we thus have here a very beautiful correspondence between the oceanographical and the zoogeographical results, such is not to any striking degree the case with the supposed connection between South America and Africa. There is a distinct mid-Atlantic ridge going from Tristan d'Acunha (which is again in connection with the Kerguelen-ridge) northwards to Ascension and then further north to St. Paul, the Azores and Iceland. But there can scarcely be said to be distinct indications of a former land-bridge from South America to Africa, as wanted by the Archhelenis-theory. Judging from the bathymetrical map given by SCHOTT * there would be more reason to conclude that both a northern bridge, over Fernando Noronha, St. Paul to Guinea, and a southern, from North of La Plata over Tristan d'Acunha to Walfish Bay, had existed. In any case the deep West African basin does not correspond well with a land connection between the two Continents in the extension supposed by IHERING to have existed in the Eocene period. — Though, I agree, this is no definite proof against the former existence of the Archhelenis-bridge, it is certainly not in favour of this theory.

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[1] Cf. STANLEY GARDINER, Notes and Observations on the Distribution of the Larvæ of Marine Animals. Anm. Mag. Nat. Hist. 7 ser. XIV. 1904, p. 403.

[2] WILLIAM S. BRUCE, Some results of the Scottish National Antarctic Expedition. Scottish Geograph. Magaz. Vol. XXI, 1905.

The question of bipolarity among Echinoderms has been so fully discussed that it may well be regarded as an established fact that there is no case known of a real bipolar species of Echinoderms. (Cf. Echinoiden d. deutschen Südpolar-Expedition p. 103—104.) Meantime A. H. CLARK has quite recently, in a very interesting paper »The recent Crinoids and their relation to Sea and Land» (The Geographical Journal 1908, p. 602) established a »Polar-Pacific» region (or fauna), »embracing the Arctic and Antarctic Seas, and the entire Pacific Coast of North and South America». »The unstalked Crinoids occurring here belong exclusively to the Antedonidæ; *Heliometra* occurs everywhere; *Thaumatometra* and *Isometra* are found in the Antarctic section only, and *Hathrometra* only in the Arctic.» The main reason for uniting both antarctic and arctic sea into one »Fauna» is evidently the occurrence of the genus *Heliometra* in both. I am not going to enter in a more detailed manner upon this matter, I would only point out that the Echinoids decidedly bear no evidence for the connection between the antarctic and the arctic fauna. The Echinoid fauna of the Patagonian-Chilian region does not reach the Gulf of Panama (the alleged occurrence of *Austrocidaris canaliculata* at Altata is evidently wrong, cf. above p. 20), and there is no nearer relation whatever between the Echinoid faunas of the North American and the South American Pacific Coast.

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* GERH. SCHOTT, Oceanographie u. maritime Meteorologie. Wissensch. Ergebn. d. deutschen Tiefsee-Exped. I. 1902.

It is worth noticing that the fauna of fossil (probably miocene) Patagonian Echinoids known through the works of Ortmann[1], De Loriol[2] and Lambert[3] bears at least some evidence for a relation to the recent fauna. The *Goniocidaris jorgensis* De Loriol is doubtless related to *Austrocidaris canaliculata*, if not its direct ancestor; the *Psammechinus Iheringi* De Loriol might well be a near relative to *Notechinus magellanicus*. The other species do not with certainty point towards the recent forms, and — as pointed out by Lambert (Op. cit. p. 483) — there are no forms among them having any relation to such of the recent forms as *Arbacia*, *Loxechinus* and *Abatus*. On the other hand, I would especially point out that there is no *Spatangus* or *Echinocardium* among the fossil forms, which might have given an indication of the supposed former connection with South Africa. Upon the whole the fossil Patagonian Echinoid fauna does not show any distinct relation to other faunas than the recent Patagonian.

List of the littoral Echinoids of the Patagonian-Chilian Region.[4]

Name.	Atlantic coast; Northern limit.	Pacific coast Northern limit.	South Georgia.	Antarctic Coast.
Ctenocidaris speciosa Mrtsn			+	+
Austrocidaris canaliculata (A. Ag.) . .	+ To 44° S.			(?)
» *spinulosa* Mrtsn	(Falkland Islands)			
Arbacia Dufresnii (Blv.)	+ To La Plata	+ To 42° S.		+
Notechinus magellanicus (Phil.)	+ » » »	+ » 12° S.		
Sterechinus Agassizii Mrtsn	+ To 50° S.	(?)		
» *Neumayeri* (Meissn.) . . .			+	+
Loxechinus albus (Mol.)	(+) Magellan Strait	+ To 12° S.		
Abatus cavernosus (Phil.)[5]	+ To 52° S.	(?)	+	(?)
» *Philippii* Lovén[5]	+ To La Plata			
» *Agassizii* (Pfeffer)[5]	(?)		+	(?)
Tripylus excavatus Phil.[5]	+ To 50° S.	+ (? »Chili»)		
Schizaster (*Tripylaster*) *Philippii* (Gray)	+ To La Plata	+ To 42° S.		
Amphipneustes Koehleri Mrtsn			+	

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[1] Report of the Princeton Univ. Exped. to Patagonia. Vol. IV. 1902. Invertebrates. Not seen by the author.

[2] Notes pour servir à l'étude des Échinodermes. 2 Sér. I. 1902.

[3] Note sur les Échinides recueillies par M. A. Tournouer en Patagonie. Bull. Soc. Géol. de France. 1903.

[4] A complete list of the antarctic-subantarctic Echinoid fauna is given in »Die Echinoiden d. deutschen Südpolar-Expedition». 1909, p. 105.

[5] The limits of these species must be regarded as uncertain on account of the confusion reigning here in the previous literature.

Plate I.

Ctenocidaris speciosa MRTSN. Abactinal side. Most of the radioles of this specimen are wholly invested with the colonies of a Bryozoon of the genus *Alcyonidium*. Nat. size.

Plate II.

Ctenocidaris speciosa MRTSN. Actinal side. Most of the radioles are closely set with a bivalve Mollusc of the genus *Limopsis*. Nat. size.

Plate III.

Fig. 1. *Ctenocidaris speciosa* MRTSN. Abactinal side.
» 2. » » » Actinal »
» 3. *Austrocidaris spinulosa* MRTSN. Actinal side.
» 4. » » » Abactinal »
» 5. » » » Young specimen. Side view.
» 6. » *canaliculata* (A. AG.) Abactinal side.
» 7. » » » Actinal »
» 8. » » » Side view.
All the figures natural size.

Plate IV.

Fig. 1. *Ctenocidaris speciosa* MRTSN. Side view.
» 2. » » » Abactinal side.
» 3. » » » Actinal »
» 4. *Austrocidaris canaliculata* (A. AG.). Side view.
» 5. » » » Female specimen. Abactinal side.
» 6. » » » Male » » »
» 7. » » » Abactinal side.
» 8. » » » Side view.
» 9. » » » Female specimen. Abactinal side.
» 10. » » » » » » »
» 11. » » » Actinal side.
The figures 4, 8, and 11 slightly magnified, the rest natural size.

Plate V.

Fig. 1. *Arbacia crassispina* Mrtsn. Actinal side.
» 2. » » » Side view.
» 3. » » » Abactinal side. Figs. 1—3 represent the same specimen.
» 4. » *Dufresnii* (Blv.). Abactinal side.
» 5. » » » Side view. Same specimen as Fig. 4.
» 6. » *alternans* (Troschel). Type specimen. Abactinal side.
» 7. » » » » » Side view.
» 8. » *Dufresnii* (Blv.). Actinal side. Same specimen as Figs. 10—11.
» 9. » » » Side view. Same specimen as Fig. 12.
» 10. » » » » » » » » Figs. 8 and 11.
» 11. » » » Abactinal side. » » » » 8 » 10.
» 12. » » » » » » » » Fig. 9.
» 13. » *africana* (Troschel). Side view.
» 14. » » » Actinal side.
» 15. » » » Abactinal »

All the figures natural size.

Plate VI.

Fig. 1. *Loxechinus albus* (Mol.). Abactinal side.
» 2. » » » Actinal »
» 3. » » » » »
» 4. » » » Abactinal side.
» 5. » » » Side view.
» 6. » » » » »
» 7—8. *Sterechinus Neumayeri* (Meissn.). Abactinal side.
» 9. *Sterechinus Agassizii* Mrtsn. Abactinal side.
» 10. » » » Side view.
» 11. » » » Abactinal Side.
» 12. » » » Actinal side.

Figs. 1—2 and 5, figs. 3—4 and 6, and figs. 10—12 represent the same specimen in different views.

All the figures natural size.

Plate VII.

Fig. 1. *Sterechinus Neumayeri* (Meissn.). Abactinal side.
» 2. » » » Actinal side. Same specimen as Fig. 1.
» 3. » *Agassizii* Mrtsn. Abactinal side.
» 4. » *Neumayeri* (Meissn.). Abactinal side.

All the figures natural size.

Plate VIII.

All the figures represent *Loxechinus albus*, natural size.

Fig. 1. Side view
» 2. Abactinal side } Same specimen.
» 3. Actinal side
» 4. Abactinal side.

Plate IX.

All the figures represent *Abatus cavernosus;* all $^{3\cdot5}/_{1}$.

Fig. 1. Actinal side of a specimen of 9 mm. length.
» 2. Abactinal » » » » » 8.5 » »
» 3. Posterior end » » » » 6 » »
» 4. Actinal side » » » » 6.5 » »
» 5. » » » » » » 8.5 » »
» 6. Abactinal » » » » » 9 » »
» 7. » » » » » » 12 » »
» 8. Actinal » » » » » 8 » »
» 9. Abactinal » » » » » 8 » »
» 10. Actinal » » » » » 12 » »
» 11. » » » » » » 16 » »
» 12. » » » » » » 7 » »
» 13. Abactinal » » » » » 4 » »
» 14. Actinal » » » » » 4 » »
» 15. Abactinal » » » » » 7 » »
» 16. » » » » » » 16 » »
» 17. » » » » » 6 » »
» 18. » » » » » » 6.5 » »
» 19. Actinal » » » » » 5.5 » »
» 20. » » » » » » 6 » »
» 21. » » » » » » 18 » »
» 22. Abactinal » » » » » 5.5 » »
» 23. Actinal » » » » » 5 » »
» 24. Abactinal » » » » » 5 » »
» 25. » » » » » » 18 » »

Plate X.

Fig. 1. *Abatus Agassizii*, young specimen; actinal side. $^{3\cdot5}/_{1}$. Same specimen as Fig. 3.
» 2. » *cavernosus;* high form ♀. Abactinal side. $^{1}/_{1}$.
» 3. » *Agassizii;* same specimen as fig. 1. Abactinal side. $^{3\cdot5}/_{1}$.
» 4. » *cavernosus;* high form. ♀. Abactinal side. $^{1}/_{1}$.
» 5. » *Agassizii.* ♀. Abactinal side. $^{1}/_{1}$.
» 6. » *cavernosus*, young specimen. Abactinal side. $^{1}/_{1}$.

Fig. 7. *Abatus cavernosus.* ♂. Abactinal side. $^1/_1$.
» 8. » » ; elongate form. ♂. Abactinal side. $^1/_1$.
» 9. » *Agassizii.* ♂. Abactinal side. $^1/_1$.
» 10. » *cavernosus.* ♀. » » »
» 11. » » ; elongate form. ♀. Abactinal side. $^1/_1$.
» 12. » » » » Actinal side. $^1/_1$.
» 13. » » . Abactinal side. The white spots are specimens of a commensalistic bivalve Mollusc (*Lepton* sp.). $^1/_1$.
» 14. » *Agassizii.* Type specimen. Abactinal side. $^1/_1$.

Plate XI.

Fig. 1. *Tripylus excavatus;* side view. Same specimen as Figs. 14 and 16. $^1/_1$.
» 2. *Amphipneustes Koehleri;* abactinal side. Same specimen as Fig. 4. $^{3\cdot5}/_1$.
» 3. » » ♂. Abactinal side. $^1/_1$.
» 4. » » Actinal side. Same specimen as Fig. 2. $^{3\cdot5}/_1$.
» 5. » » ♀. Side view. Same specimen as Figs. 15 and 18. $^1/_1$.
» 6. *Abatus Philippii.* Type specimen. ♂. Abactinal side. $^1/_1$.
» 7. *Amphipneustes Koehleri.* ♂. Side view. Same specimen as Fig. 3. $^1/_1$.
» 8. » » » Actinal side. Same specimen as Fig. 3. $^1/_1$.
» 9. *Abatus Philippii.* Abactinal side. $^1/_1$.
» 10. » » ♀. Abactinal side. $^1/_1$.
» 11. » » ♂. » » (These specimens were identified by Lo-
» 12. » » ♀. » » vén as *A. cavernosus.*) $^1/_1$.
» 13. » » ♂. » » Type specimen. $^1/_1$.
» 14. *Tripylus excavatus.* ♂. » » Same specimen as Figs. 1 and 16. $^1/_1$.
» 15. *Amphipneustes Koehleri.* ♀. Abactinal side. Same specimen as Figs. 5 and 18. $^1/_1$.
» 16. *Tripylus excavatus.* Actinal side. Same specimens as Figs. 1 and 14. $^1/_1$.
» 17. *Amphipneustes Lorioli.* Abactinal side. Same specimen as Fig. 19. $^1/_1$.
» 18. » *Koehleri.* Actinal side Same specimen as Figs. 5 and 15. $^1/_1$.
» 19. » *Lorioli.* » » » » » Fig. 17. $^1/_1$.

Plate XII.

Fig. 1. *Amphipneustes Koehleri,* young specimen. Abactinal side. Note the large globiferous pedicellariæ. $^{3\cdot5}/_1$.
» 2. *Tripylus excavatus;* hind view. Same specimens as Figs. 4, 6 and 9. $^1/_1$.
» 3. *Amphipneustes Koehleri.* Actinal side. Same specimen as Figs. 5 and 7. $^1/_1$.
» 4. *Tripylus excavatus.* Abactinal side. Same specimen as Figs. 2, 6 and 9. $^1/_1$.
» 5. *Amphipneustes Koehleri.* Abactinal side. Same specimen as Figs. 3 and 7. $^1/_1$.
» 6. *Tripylus excavatus.* Actinal side. Same specimen as Figs. 2, 4 and 9. $^1/_1$.
» 7. *Amphipneustes Koehleri.* Side view. Same specimen as Figs. 3 and 5. $^1/_1$.
» 8. *Schizaster (Tripylaster) Philippii.* Side view. Same specimen as Figs. 10 and 11. $^1/_1$.
» 9. *Tripylus excavatus.* Side view. Same specimen as Figs. 2, 4 and 6. $^1/_1$,

Fig. 10. *Schizaster* (*Tripylaster*) *Philippii.* Actinal side. Same specimen as Figs. 8 and 11. $^{1}/_{1}$.
» 11. *Schizaster* (*Tripylaster*) *Philippii.* Abactinal side. Same specimen as Figs. 8—10. $^{1}/_{1}$.

Plate XIII.

All the figures refer to *Ctenocidaris speciosa* Mrtsn.

Fig. 1. Interambulacrum of a specimen infested with *Echinophyces;* the small pore in the middle is the transferred genital opening. $^{4}/_{1}$.
» 2. Apical system of a female specimen. $^{2\cdot4}/_{1}$.
» 3. Interambulacrum, seen from the inside, from a specimen infested with *Echinophyces;* most of the genital gland has been prepared away in order to show the course of the extraordinary genital duct. $^{4}/_{1}$.
» 4. Valve of globiferous pedicellaria, from the inside. (Comp. Fig. 14.) $^{70}/_{1}$.
» 5. Transverse section of radiole. $^{50}/_{1}$.
» 6. Actinal radiole of a young specimen, 3 mm. in diameter. $^{35}/_{1}$.
» 7. » » » » grown » ; side view. $^{3\cdot5}/_{1}$.
» 8. » » » » » » ; front view. $^{3\cdot5}/1$.
» 9. Valve of globiferous pedicellaria from a specimen infested with *Echinophyces;* from the inside. $^{125}/_{1}$.
» 10. Actinal radiole; front view. $^{3\cdot5}/_{1}$
» 11. Abactinal radiole. $^{3\cdot5}/_{1}$.
» 12. Actinal » $^{3\cdot5}/_{1}$.
» 13. Part of an ambulacrum. $^{10}/_{1}$.
» 14. Valve of globiferous pedicellaria; side view. (Comp. Fig. 4.) $^{70}/_{1}$.
» 15. Actinal radiole. $^{3\cdot5}/_{1}$.

Plate XIV.

Fig. 1. Part of an ambulacrum of *Austrocidaris canaliculata.* $^{16}/_{1}$.
» 2. Auricule of *Austrocidaris canaliculata;* seen from the oral side. $^{8}/_{1}$.
» 3. Part of an ambulacrum of *Austrocidaris spinulosa.* $^{14}/_{1}$.
» 4. Actinal radiole » » » (Comp. Figs. 12—13.) $^{6\cdot8}/_{1}$.
» 5. Valve of small globiferous pedicellaria of *Austrocidaris spinulosa.* Side view. $^{70}/_{1}$.
» 6. Apical system of *Austrocidaris canaliculata*, male specimen; »Altata». $^{5}/_{1}$.
» 7—8. Actinal radioles of » » (comp. Fig. 11). $^{8}/_{1}$.
» 9. Valve of small globiferous pedicellaria of *Austrocidaris canaliculata;* »Altata». $^{70}/_{1}$.
» 10. Apical system and adjoining upper coronal plates of *Austrocidaris canaliculata;* »Altata», large specimen. $^{2\cdot8}/_{1}$.
» 11. Actinal radiole of *Austrocidaris canaliculata.* (Comp. Figs. 7—8.) $^{8}/_{1}$.
» 12—13. Actinal radioles of *Austrocidaris spinulosa.* (Comp. Fig. 4.) $^{6\cdot8}/_{1}$.
» 14. Valve of small globiferous pedicellaria of *Austrocidaris spinulosa*, side view. $^{70}/_{1}$.
» 15. » » large » » » » » , from the inside. $^{70}/_{1}$.
» 16. » » small » » » » *canaliculata*, side view. $^{70}/_{1}$.

Fig. 17. Valve of small globiferous pedicellaria of *Austrocidaris canaliculata*, from the inside. $^{70}/_{1}$.
» 18. Abactinal radiole of *Austrocidaris canaliculata*. $^{6 \cdot 5}/_{1}$.

Plate XV.

Fig. 1. Part of ambulacrum of *Arbacia crassispina*. $^{8}/_{1}$.
» 2. Valve of triphyllous pedicellaria of *Arbacia Dufresnii*. $^{175}/_{1}$.
» 3. Part of ambulacrum of *Arbacia Dufresnii*. $8/_{1}$.
» 4. The point of an actinal spine of *Arbacia crassispina*. $^{15}/_{1}$.
» 5. Valve of ophicephalous pedicellaria of *Arbacia crassispina*. $^{70}/_{1}$.
» 6. » » » » » » *Dufresnii*. $^{70}/_{1}$.
» 7. » » » » » » *crassispina*. $^{70}/_{1}$.
» 8. The point of an actinal spine of *Arbacia Dufresnii*. $^{15}/_{1}$.
» 9. Ocular plate of *Arbacia Dufresnii*. $^{14}/_{1}$.
» 10. Stalk of ophicephalous pedicellaria of *Arbacia Dufresnii*. $^{125}/_{1}$.
» 11. Ocular plate of *Arbacia crassispina*. $^{14}/_{1}$.
» 12. Ambulacral plates of *Tetrapygus niger*. $^{10}/_{1}$.
» 13. Valve of tridentate pedicellaria of *Arbacia Dufresnii*. $^{50}/_{1}$.
» 14. » » » » » » *crassispina*. $^{70}/_{1}$.
» 15. Ambulacral plates of *Tetrapygus niger*. $^{10}/_{1}$.

Plate XVI.

Fig. 1. Tridentate pedicellaria of *Sterechinus Agassizii*. $^{50}/_{1}$.
» 2. Valve of tridentate pedicellaria of *Loxechinus albus*. $^{65}/_{1}$.
» 3. Globiferous pedicellaria, small form, of *Notechinus magellanicus* (comp. Fig. 19). $^{50}/_{1}$.
» 4. Sphæridia of *Loxechinus albus*. $^{170}/_{1}$.
» 5. Tridentate pedicellaria of *Loxechinus albus*. $^{50}/_{1}$.
» 6. The point of a secondary spine of *Notechinus magellanicus*. $^{50}/_{1}$.
» 7. » » » » » » » *Sterechinus Agassizii*. $^{50}/_{1}$.
» 8. Group of spicules from tubefoot » » » $^{225}/_{1}$.
» 9. Spicules from tubefoot of *Notechinus magellanicus;* a. fully developed, b. developmental stage. $^{225}/_{1}$.
» 10. Abnormal, two-headed triphyllous pedicellaria of *Notechinus magellanicus;* the left head slightly restored. $^{70}/_{1}$.
» 11. Secondary spine of young *Notechinus magellanicus*. $^{50}/_{1}$.
» 12. Primary » » » » » $^{50}/_{1}$.
» 13. Outer part of secondary spine, with the point regenerated, of *Sterechinus Agassizii*. $^{50}/_{1}$.
» 14. Valve of ophicephalous pedicellaria of *Loxechinus albus*. $^{65}/_{1}$.
» 15. Globiferous pedicellaria of *Sterechinus Agassizii*. $^{45}/_{1}$.
» 16. Valve of triphyllous pedicellaria of *Loxechinus albus*. $^{170}/_{1}$.

Fig. 17. Globiferous pedicellaria of *Loxechinus albus.* $^{50}/_{1}$.

» 18. Sphæridia of *Sterechinus Agassizii.* $^{150}/_{1}$.

» 19. Globiferous pedicellaria, large form, of *Notechinus magellanicus.* (Comp. Fig. 3.) $^{50}/_{1}$.

Plate XVII.

Fig. 1. Part of the abactinal side, with the apical system of *Plexechinus Nordenskjöldi.* The upper plates of the frontal ambulacrum were not quite distinct. $^{8}/_{1}$.

» 2. Part of the actinal side of *Plexechinus Nordenskjöldi.* $^{8}/_{1}$.

» 3. *Plexechinus Nordenskjöldi.* Side view. $^{2}/_{1}$.
» 4. » » Abactinal side. $^{2}/_{1}$. Figs. 3—5 same specimen.
» 5. » » Actinal » $^{2}/_{1}$.

» 6. » » Abactinal » $^{2.5}/_{1}$.
» 7. » » Actinal » $^{2.5}/_{1}$. Figs. 6—8 same specimen.
» 8. » » Side view. $^{2.5}/_{1}$.

» 9. Part of the abactinal side, with the apical system, of a young *Abatus cavernosus*, 1.9 mm. length. $^{50}/_{1}$.

» 10. *Amphipneustes Koehleri*, young specimen from the marsupium; 2 mm. length. Same specimen as Fig. 11. $^{20}/_{1}$.

» 11. *Amphipneustes Koehleri.* Same specimen as Fig. 10. Actinal side. $^{20}/_{1}$.

Plate XVIII.

Fig. 1. *Amphipneustes Koehleri;* young specimen, 2 mm. length. Actinal side. $^{27}/_{1}$.

» 2. » » Same specimen as Fig. 1. Abactinal side. $^{27}/_{1}$.

» 3. *Abatus cavernosus;* young specimen, 1.5 mm. length, from the marsupium. Actinal side. $^{45}/_{1}$.

» 4. » » same specimen as Fig. 3. Abactinal side. $^{45}/_{1}$.

Figs. 5—12. *Plexechinus Nordenskjöldi.*

» 5. Valve of ophicephalous pedicellaria. $^{200}/_{1}$.

» 6. » » tridentate » from the inside. (Comp. Fig. 11.) $^{170}/_{1}$.

» 7. » » triphyllous » $^{200}/_{1}$.

» 8. Sphæridia. $^{170}/_{1}$.

» 9. Secondary spine. $^{115}/_{1}$.

» 10. Filament of actinal tubefoot. The pigment omitted. $^{170}/_{1}$.

» 11. Valve of tridentate pedicellaria, side view. (Comp. Fig. 6.) $^{170}/_{1}$.

» 12. Ophicephalous pedicellaria. $^{115}/_{1}$.

Plate XIX.

Fig. 1. Tridentate (bivalve) pedicellaria of *Amphipneustes Lorioli.* $^{35}/_{1}$.

» 2. » » », small form, of *Amphipneustes Lorioli.* $^{35}/_{1}$.

» 3. Valve of globiferous pedicellaria of *Amphipneustes Koehleri.* Side view. (Comp. Fig. 20.) $^{70}/_{1}$.

» 4. Sphæridia of *Amphipneustes Koehleri.* $^{110}/_{1}$.

Fig. 5. Valve of globiferous pedicellaria of *Schizaster* (*Tripylaster*) *Philippii;* side view. (Comp. Fig. 31.) $^{90}/_{1}$.

» 6. Valve of tridentate (bivalve) pedicellaria of *Amphipneustes Lorioli.* (Comp. Figs. 22, 26.) $^{70}/_{1}$.

» 7. Tridentate pedicellaria of *Schizaster* (*Tripylaster*) *Philippii.* $^{35}/_{1}$.

» 8. Valve of triphyllous pedicellaria of *Amphipneustes Koehleri.* $^{175}/_{1}$.

» 9. Spicules of *Amphipneustes Koehleri.* $^{160}/_{1}$.

» 10. Sphæridia of » *Lorioli.* $^{100}/_{1}$.

» 11. Valve of tridentate (bivalve) pedicellaria of *Amphipneustes Lorioli.* $^{95}/_{1}$.

» 12. Rostrate pedicellaria of *Amphipneustes Lorioli.* $^{50}/_{1}$.

» 13. Valve of tridentate pedicellaria of *Amphipneustes Koehleri.* $^{70}/_{1}$.

» 14. » » globiferous » , abnormal form, of *Amphipneustes Koehleri.* $^{70}/_{1}$

» 15. » » tridentate » , small form, of *Schizaster* (*Tripylaster*) *Philippii.* $^{65}/_{1}$

» 16. » » rostrate » , large » » » » » $^{55}/_{1}$

» 17. » » » » of *Amphipneustes Lorioli.* $^{95}/_{1}$.

» 18. » » tridentate » » *Tripylus excavatus.* (Comp. Fig. 44.) $^{65}/_{1}$.

» 19. » » rostrate » » *Amphipneustes Koehleri.* $^{95}/_{1}$.

» 20. » » globiferous » » » » From the inside. (Comp. Fig. 3.) $^{70}/_{1}$.

» 21. Rostrate pedicellaria of *Schizaster* (*Tripylaster*) *Philippii.* $^{35}/_{1}$.

» 22. Valve of tridentate (bivalve) pedicellaria of *Amphipneustes Lorioli.* From the inside. (Comp. Figs. 6, 26.) $^{70}/_{1}$.

» 23. Valve of tridentate pedicellaria of *Amphipneustes Koehleri.* $^{70}/_{1}$.

» 24. Globiferous pedicellaria of *Amphipneustes Koehleri.* $^{33}/_{1}$.

» 25. Valve of tridentate pedicellaria of *Amphipneustes Koehleri.* From the inside. $^{70}/_{1}$

» 26. » » » (bivalve) pedicellaria of *Amphipneustes Lorioli.* (Comp. Figs. 6, 11, 22.) $^{70}/_{1}$.

» 27. Tridentate pedicellaria of *Amphipneustes Koehleri.* $^{33}/_{1}$.

» 28. Globiferous pedicellaria of *Abatus cavernosus.* (Combined from two specimens.) $^{40}/_{1}$.

» 29. Valve of globiferous pedicellaria of *Abatus cavernosus.* From the inside. (Comp. Fig. 33.) $^{90}/_{1}$.

» 30. Valve of rostrate pedicellaria of *Abatus cavernosus.* From the inside. (Comp. Fig. 38.) $^{130}/_{1}$.

» 31. Valve of globiferous pedicellaria of *Schizaster* (*Tripylaster*) *Philippii.* From the inside. (Comp. Fig. 5.) $^{90}/_{1}$.

» 32. Valve of globiferous pedicellaria of *Abatus cavernosus*, var. *bidens.* Side view. (Comp. Fig. 39.) $^{90}/_{1}$.

» 33. Valve of globiferous pedicellaria of *Abatus cavernosus.* Side view. (Comp. Fig. 29.) $^{90}/_{1}$.

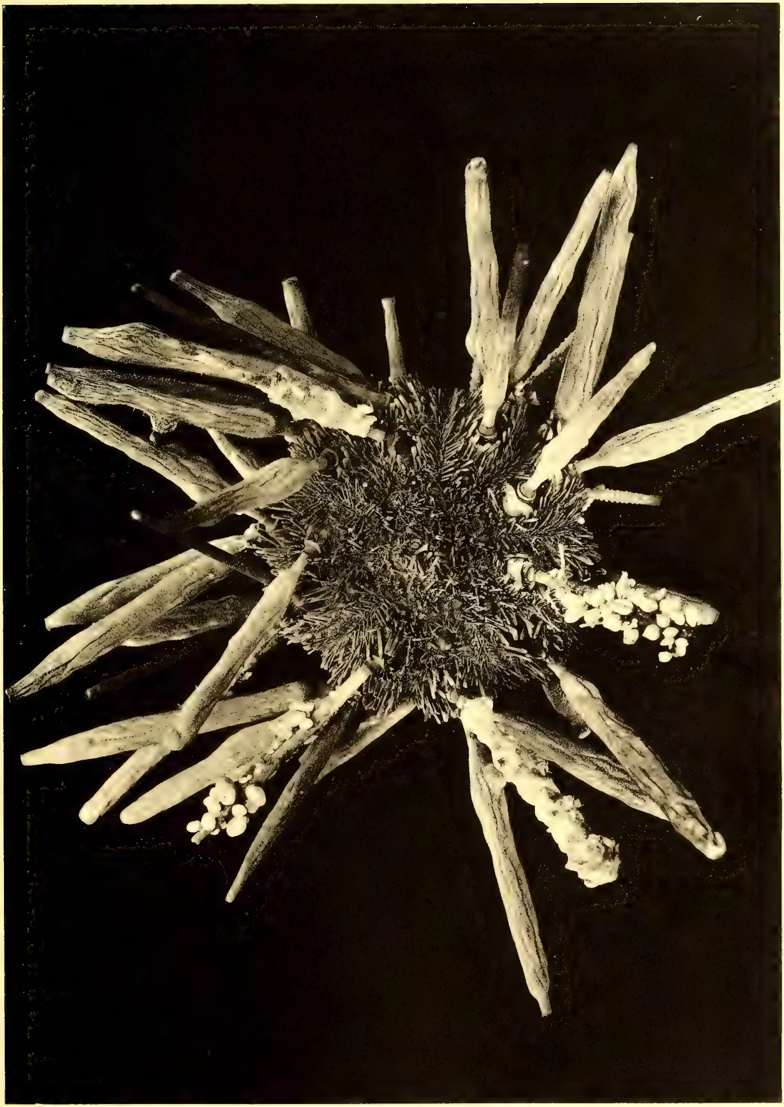
» 34. Tridentate pedicellaria of *Tripylus excavatus.* $^{50}/_{1}$.

» 35. Valve of tridentate pedicellaria of *Abatus cavernosus*, var. *bidens.* (Comp. Fig. 42.) $^{65}/_{1}$.

» 36. » » triphyllous » » » » (Comp. Fig. 43.) $^{175}/_{1}$.

» 37. » » tridentate » » » » (Comp. Figs. 46, 50.) $^{67}/_{1}$.

Fig. 38. Valve of rostrate pedicellaria of *Abatus cavernosus.* Side view. (Comp. Fig. 30.) $^{130}/_{1}$.
39. » » globiferous » » » » , var. *bidens.* From the inside. (Comp. Fig. 32.) $^{90}/_{1}$.
40. » » tridentate » » » *Agassizii.* $^{50}/_{1}$.
41. » » » » » » *cavernosus* (Patagonian Bank). $^{65}/_{1}$.
42. » » » » » » » var. *bidens.* (Comp. Fig. 35.) $^{65}/_{1}$.
43. » triphyllous » » » » , side view. (Comp. Fig. 36.) $^{175}/_{1}$.
44. » » tridentate » » *Tripylus excavatus.* (Comp. Fig. 18.) $^{65}/_{1}$.
45. Rostrate pedicellaria of *Abatus cavernosus.* $^{45}/_{1}$.
46. Valve of tridentate pedicellaria of *Abatus cavernosus.* (Comp. Figs. 37, 50.) $^{67}/_{1}$.
47. » » » » » *Abatus Philippii.* $^{67}/_{1}$.
48. Globiferous pedicellaria of *Schizaster* (*Tripylaster*) *Philippii.* $^{40}/_{1}$.
49. Valve of tridentate pedicellaria of *Schizaster* (*Tripylaster*) *Philippii.* $^{65}/_{1}$.
50. » » » » » *Abatus cavernosus.* (Comp. Figs. 37, 46.) $^{67}/_{1}$.
51. Tridentate pedicellaria of *Abatus cavernosus.* $^{45}/_{1}$.



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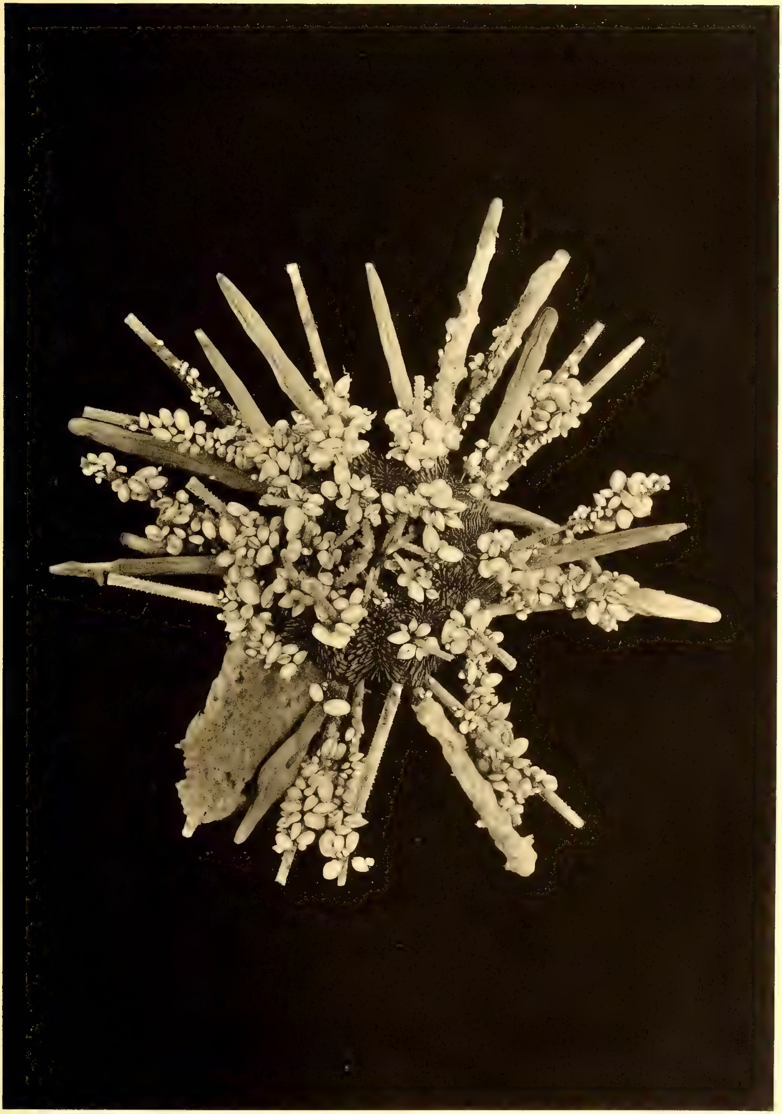
Ctenocidaris speciosa Mrtsn.



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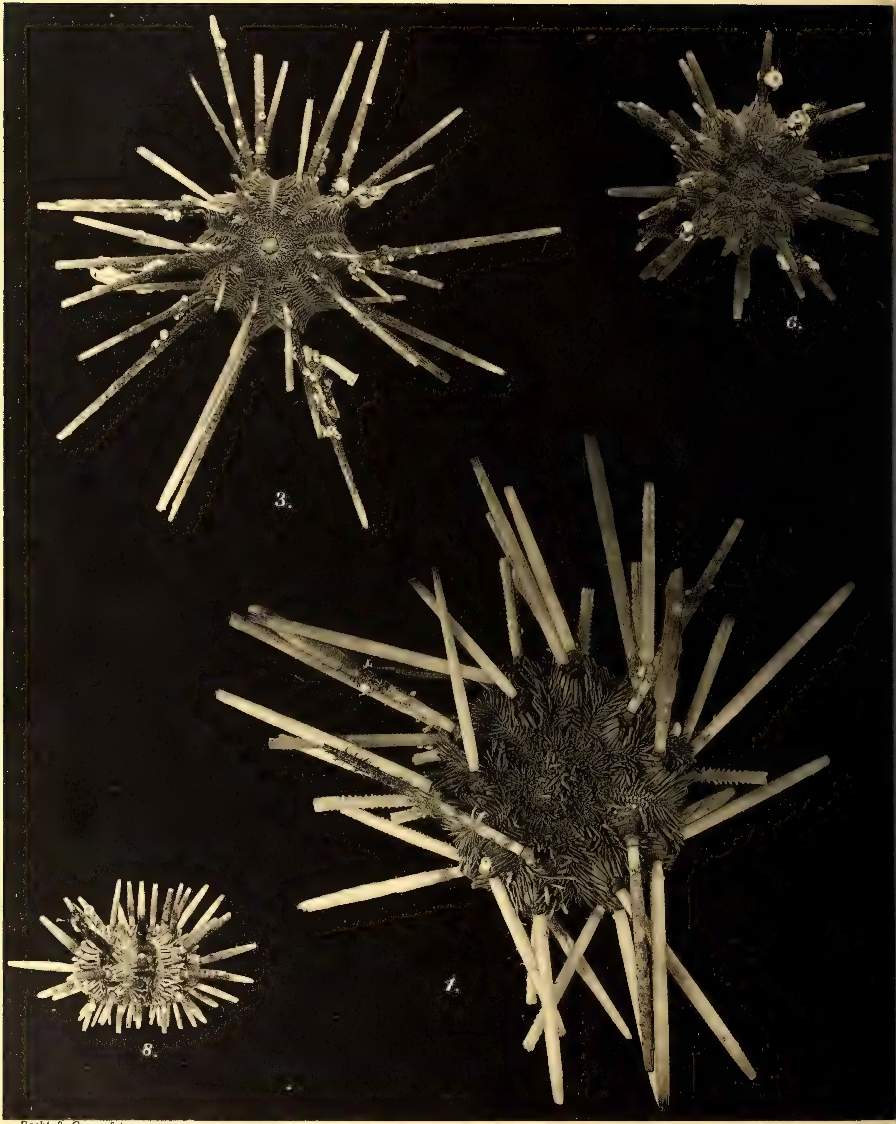

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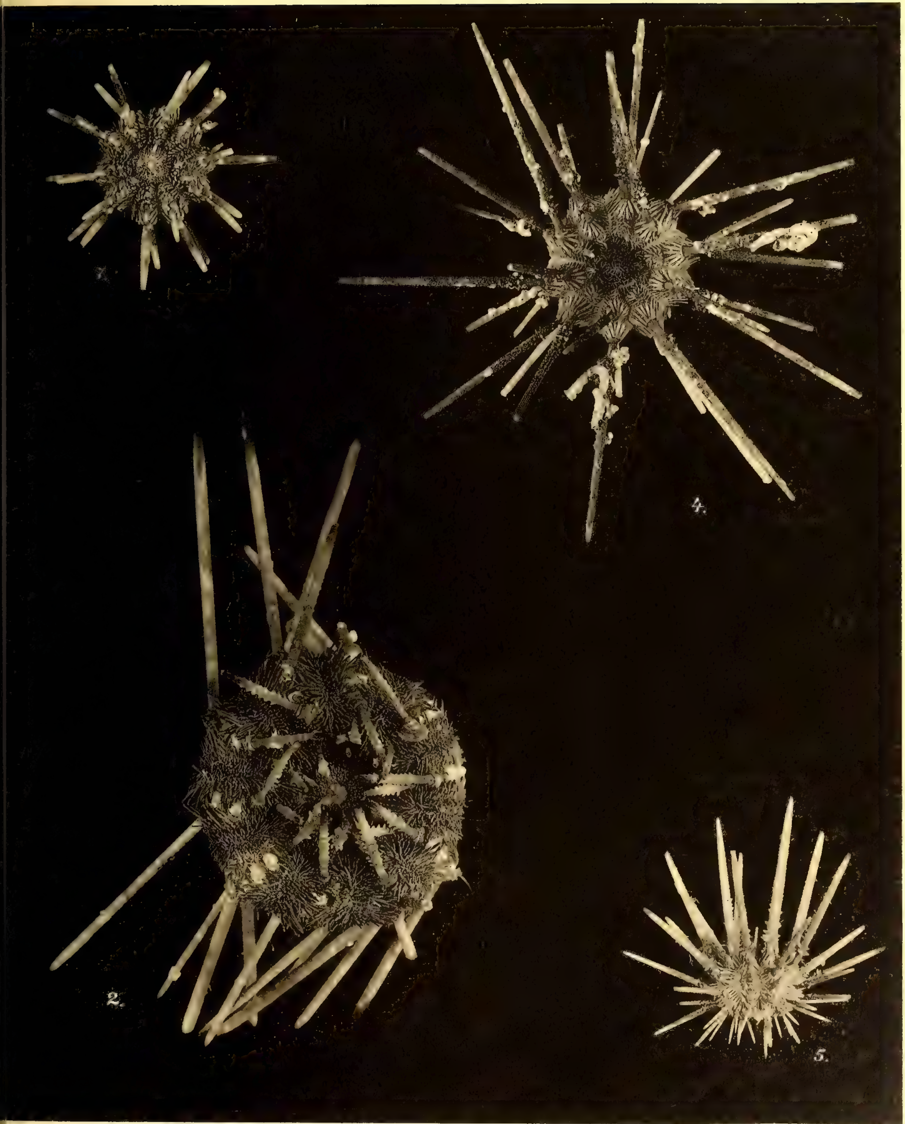
1—2. *Ctenocidaris speciosa Mrtsn.* 3—5. *Austrocidaris*



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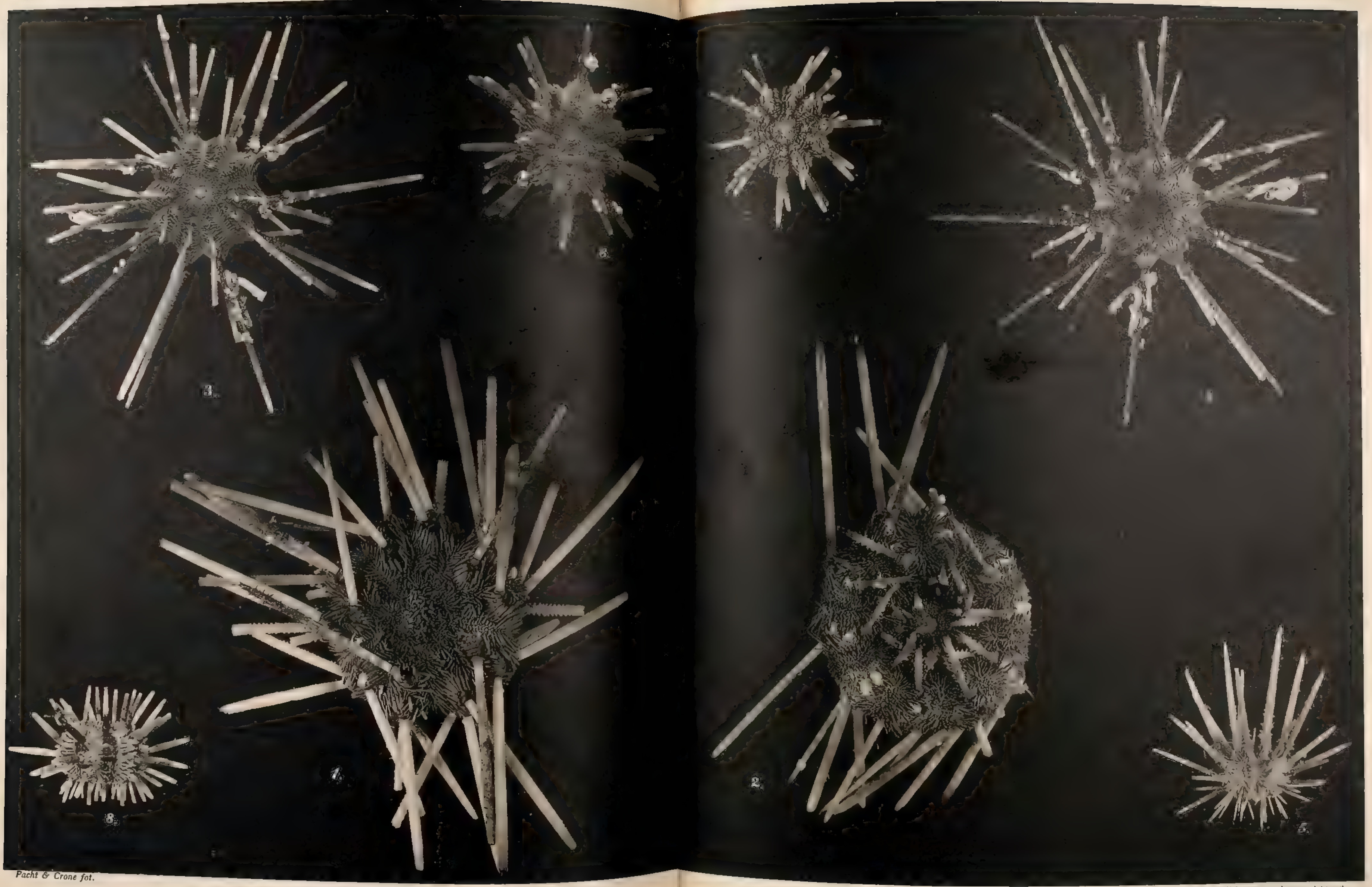
losa Mrtsn. 6—8. *Austrocidaris canaliculata (A. Ag).*



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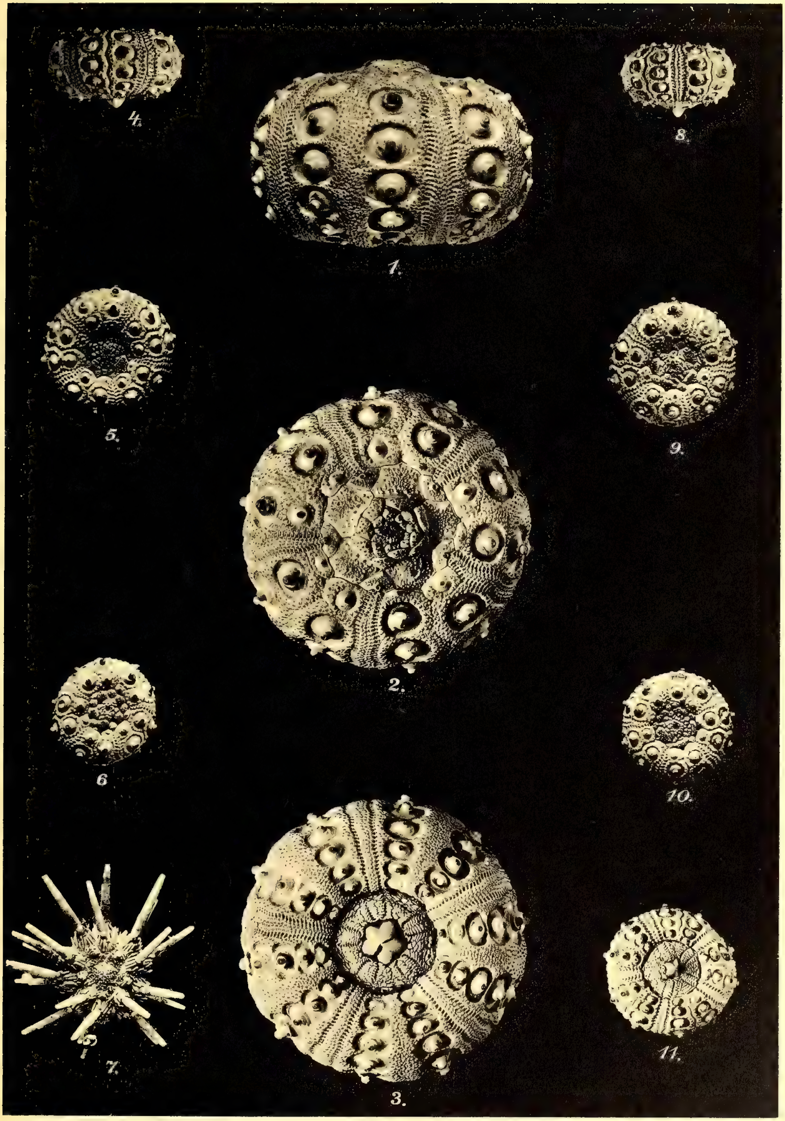

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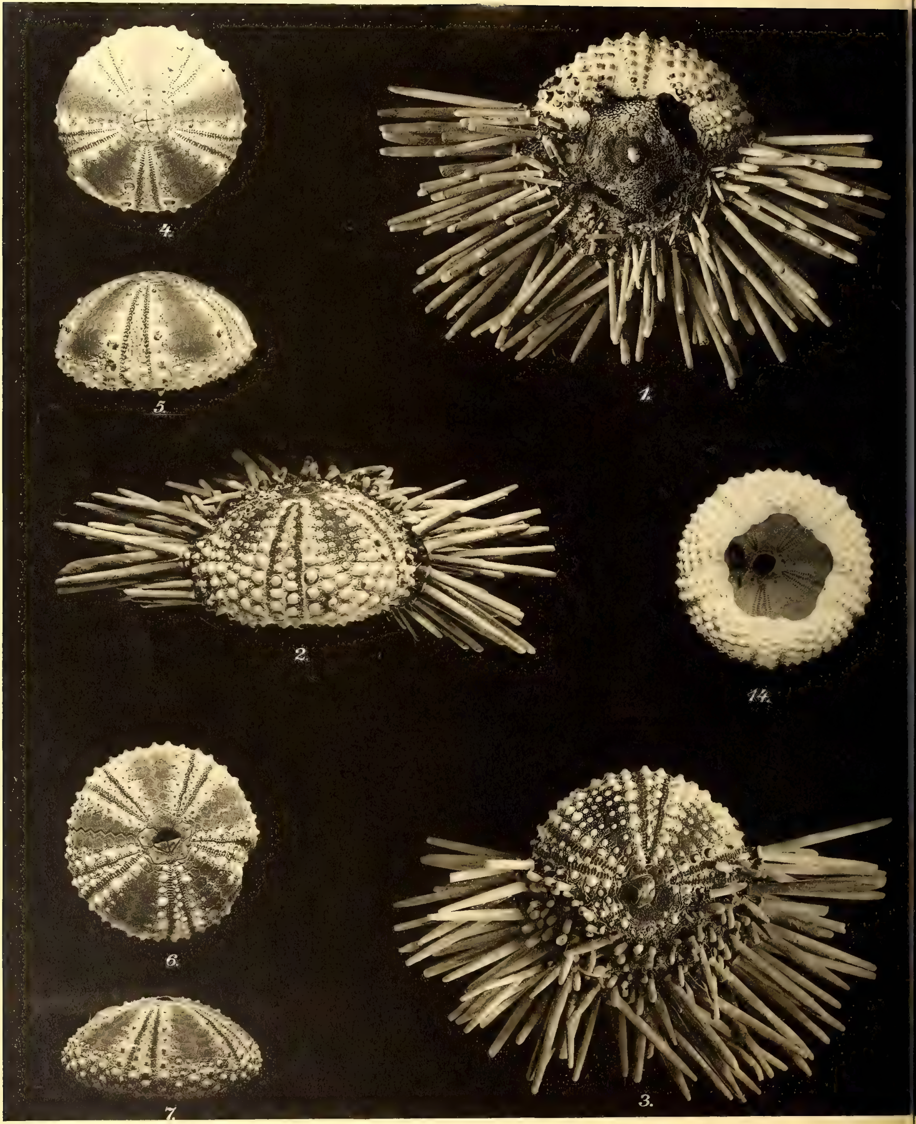
1—3. *Ctenocidaris speciosa Mrtsn.* 4—11. *Austrocidaris canaliculata (A. Ag.).*



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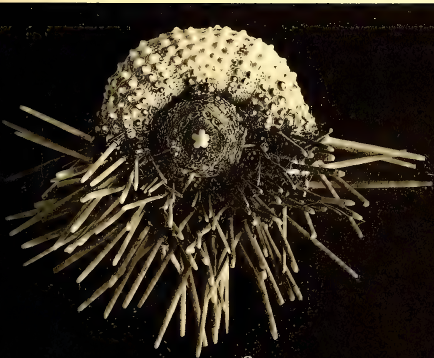
1—3. *Arbacia crassispina Mrtsn.* 4—12. *A.*



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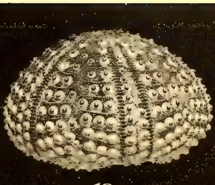

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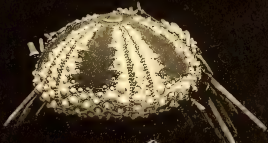

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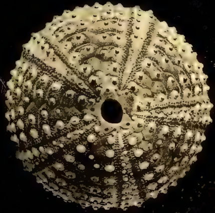

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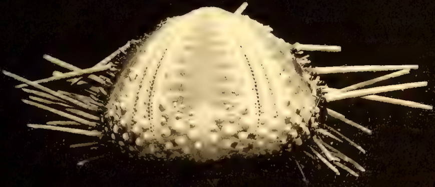

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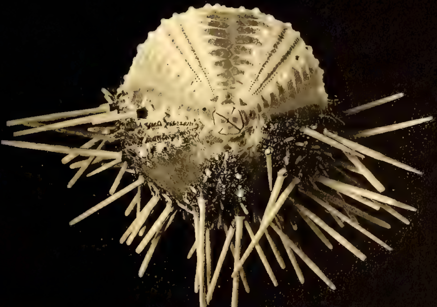

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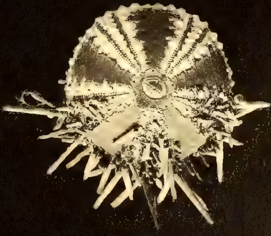

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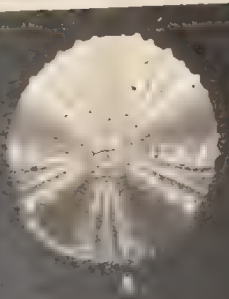
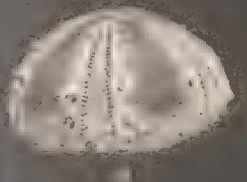
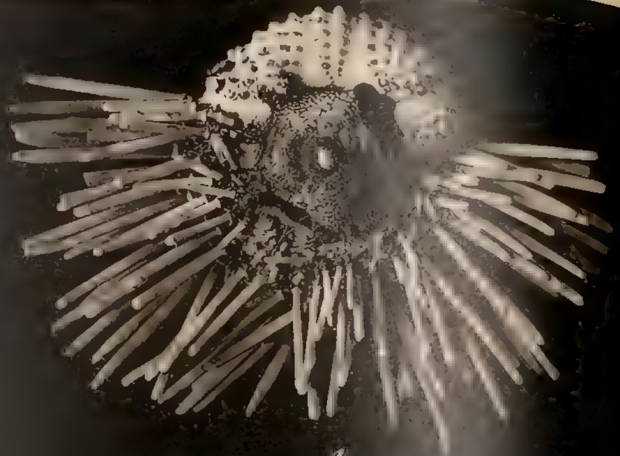
snii (Blv.). 13—15. *A africana (Troschel).*



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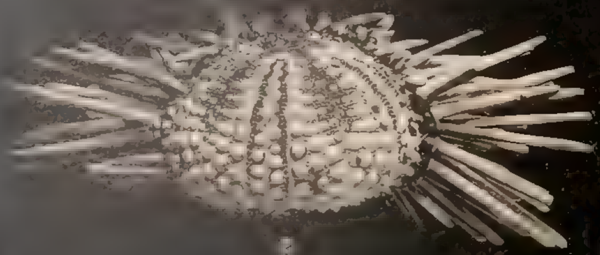

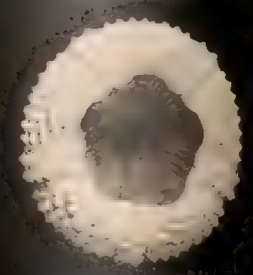
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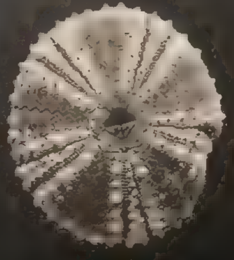
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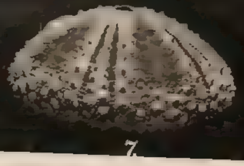
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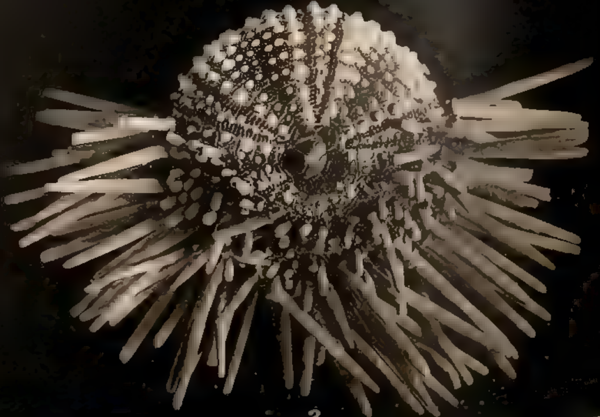
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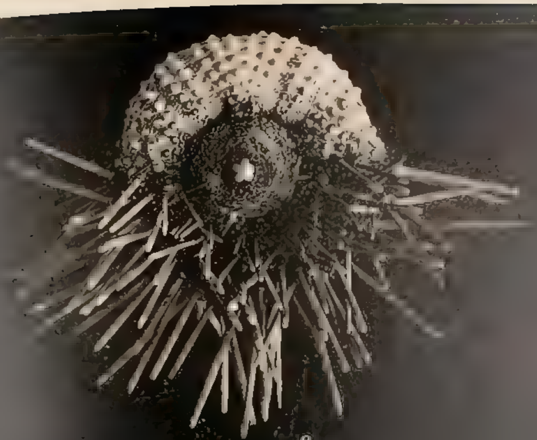
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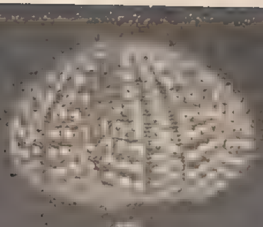

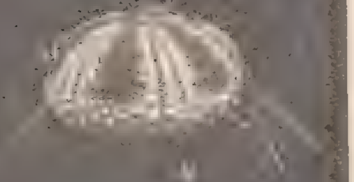

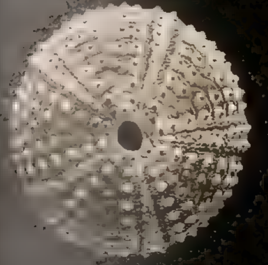
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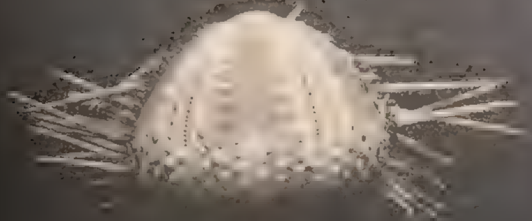
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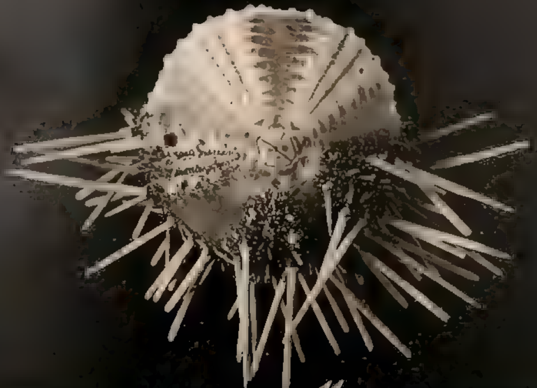
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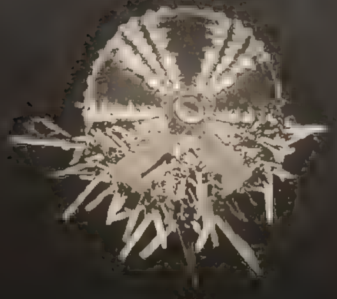
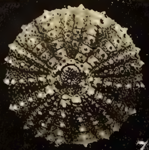

12.

Pacht & Crone fot.

Ljustr. A.B. Lagrelius & Westphal Stockh.

1—3. *Arbacia crassispina* Mrtsn. 4—12. *A. Dufresnii* (Blv.). 13—15. *A africana* (Troschel).



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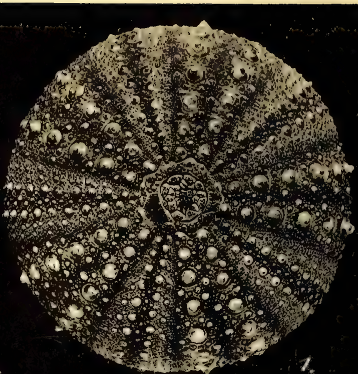

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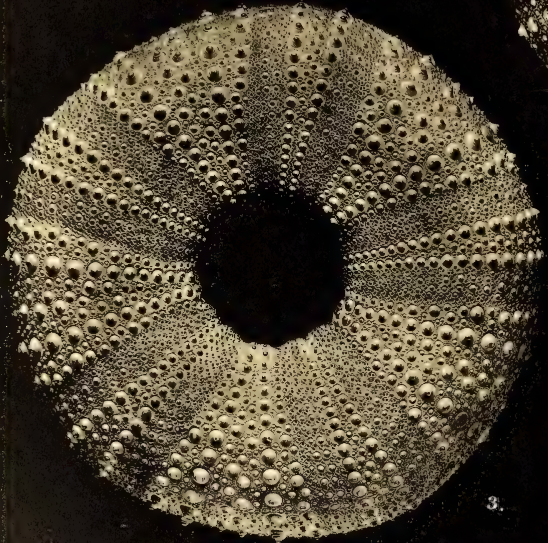

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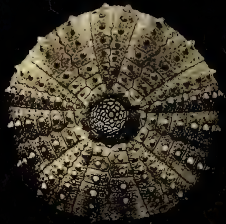

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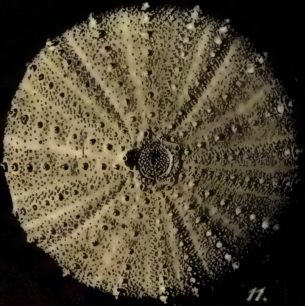

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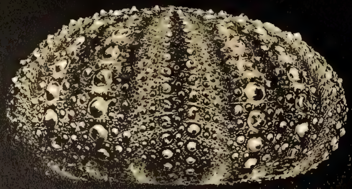
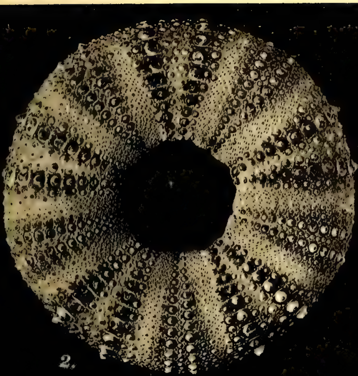


5.

Pacht & Crone fot.

1—6. *Loxechinus albus* (Mol.). 7—8. *Sterechinus* N



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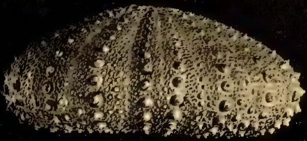

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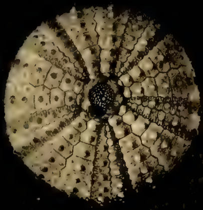

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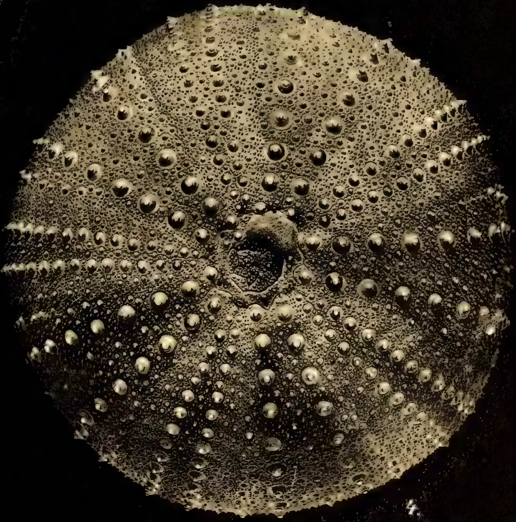

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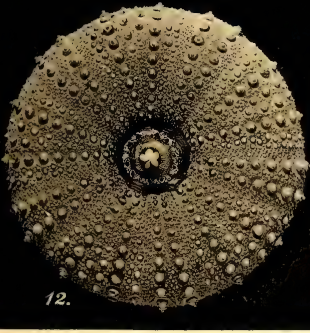

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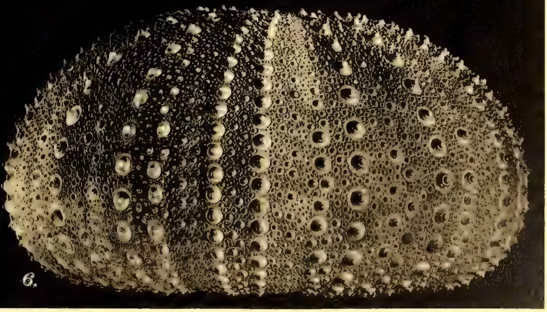
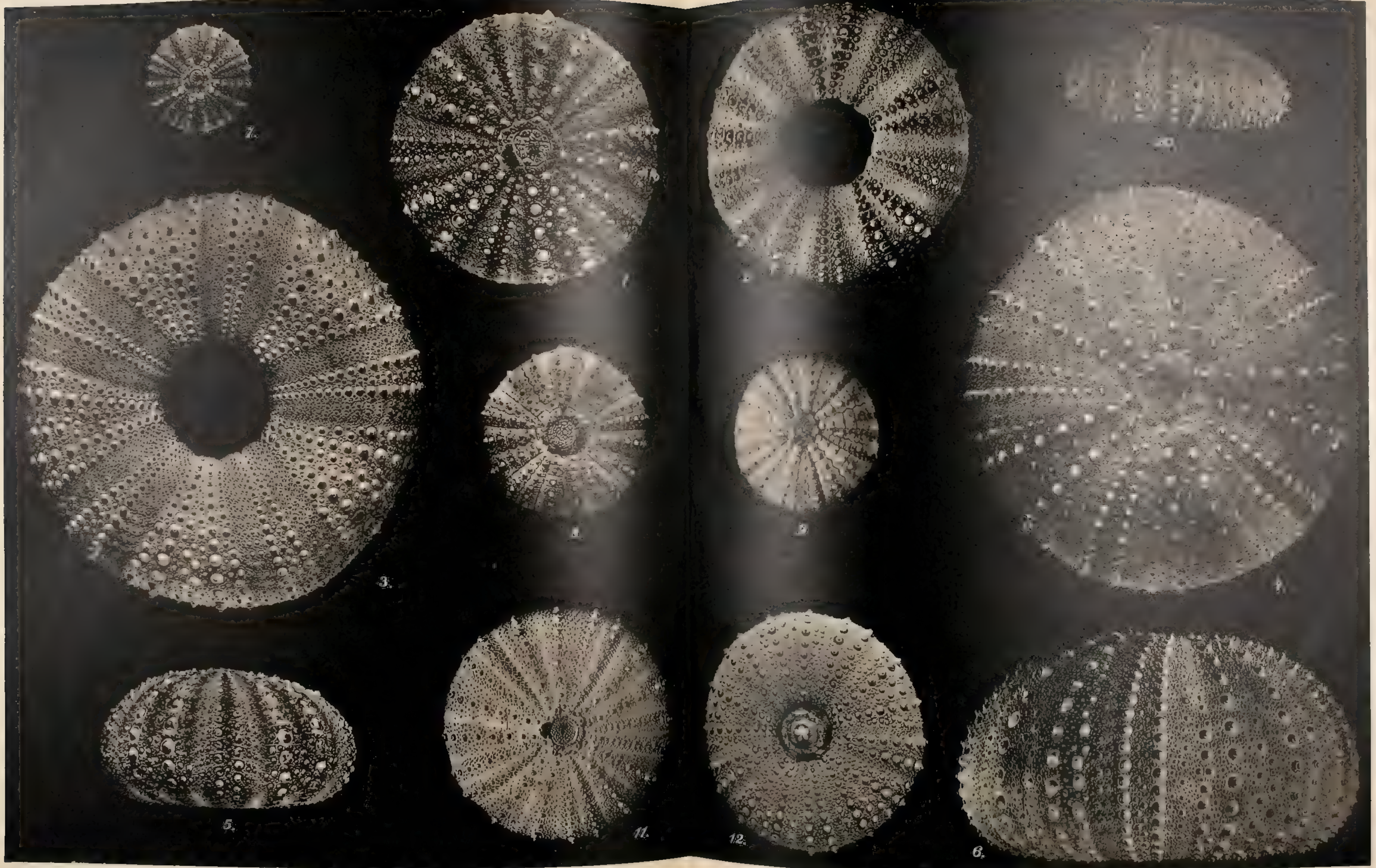


6.

Ljustr. A.B. Lagrelius & Westphal. Stockh.

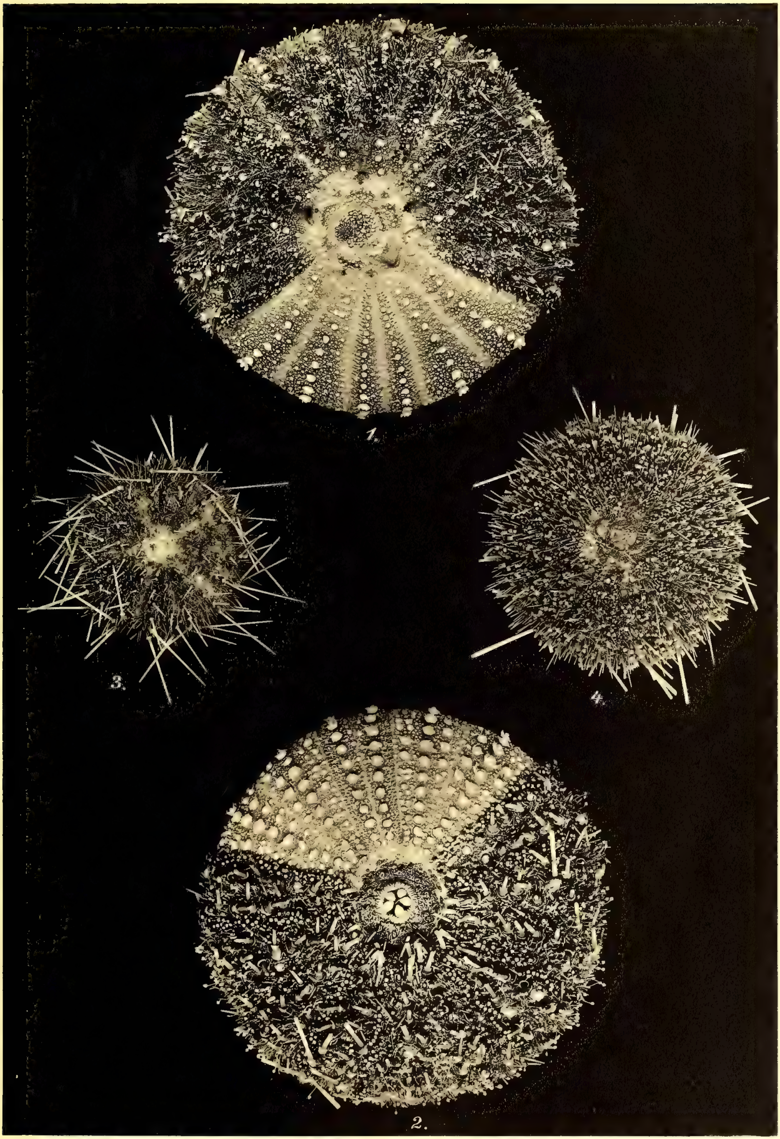
ayeri (Meissner). 9—12. *Sterechinus Agassizii Mrtsn.*



Pacht & Crone fot.

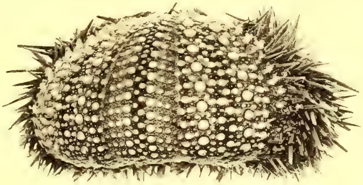
Ljustr. A.B. Lagrelius & Westphal Stockh.

1—6. *Loxechinus albus (Mol.).* 7—8. *Sterechinus Neumayeri (Meissner).* 9—12. *Sterechinus Agassizii Mrtsn.*



Pacht & Crone fot. Ljustr. A.B. Lagrelius & Westphal Stockh.

1, 2, 4. *Sterechinus Neumayeri (Meissner).* 3. *Sterech. Agassizii Mrtsn.*



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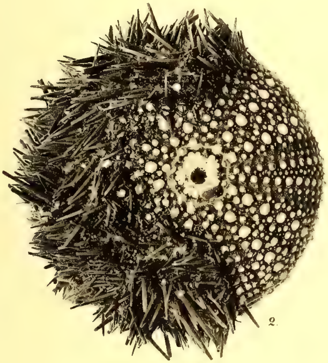

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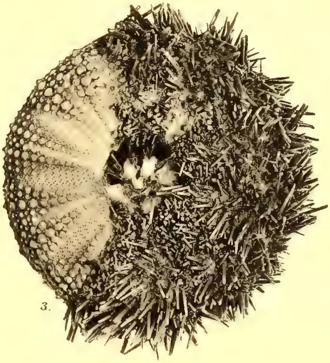

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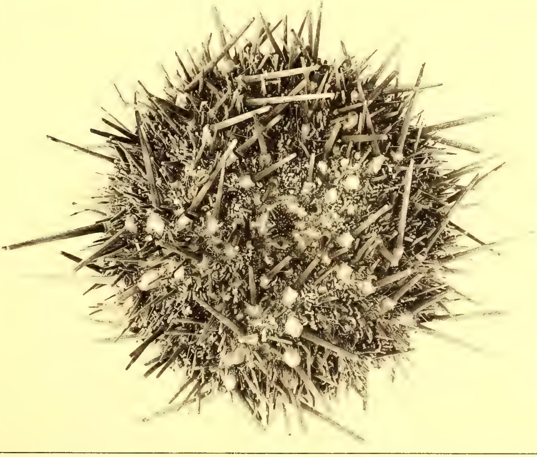
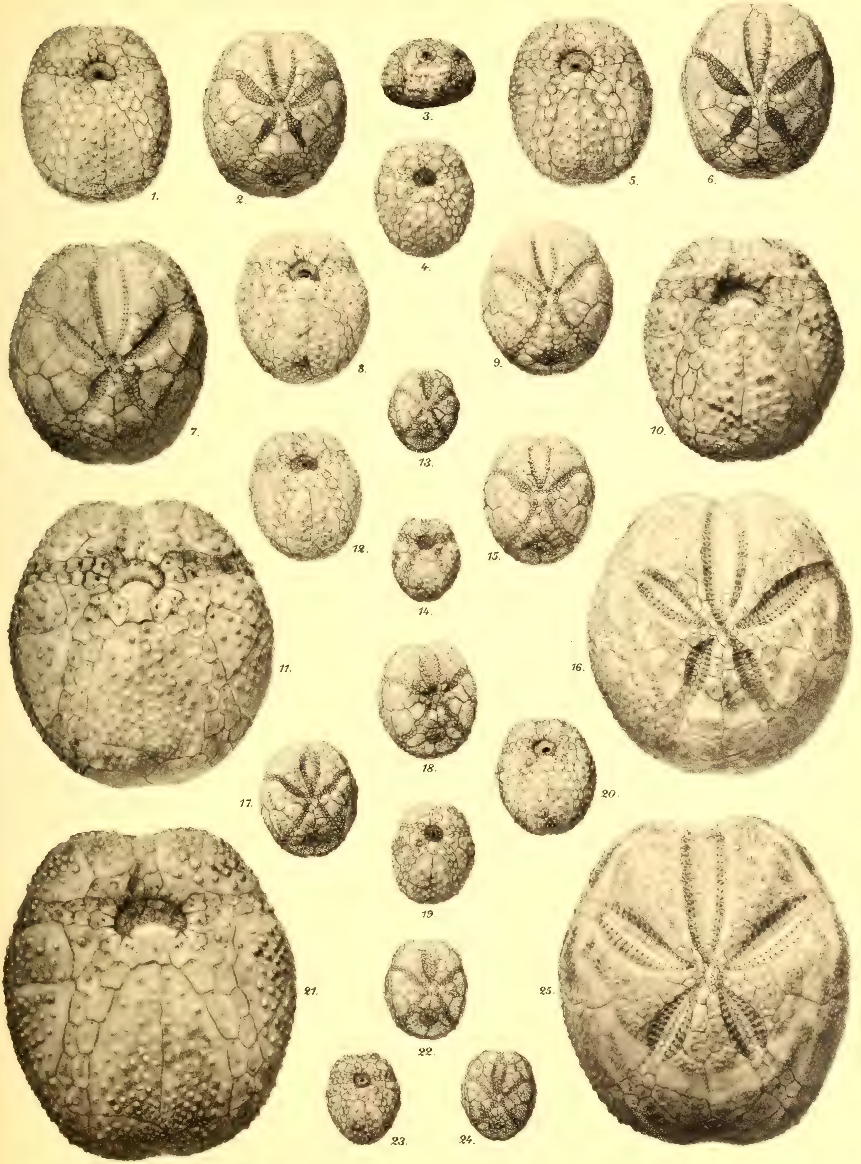


Pacht & Crone fot.

Ljustr. A.B. Lagrelius & Westphal. Stockh

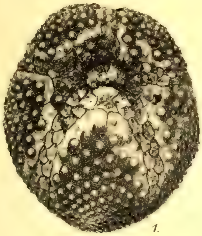
Loxechinus albus (Mol.).



Th. Bloch fot.

Ljustr. A.B. Lagrelius & Westphal, Stockh.

Abatus cavernosus (Phil.).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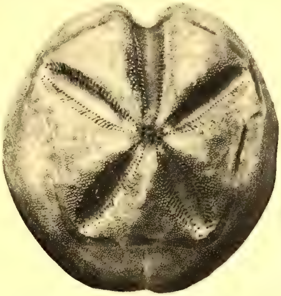
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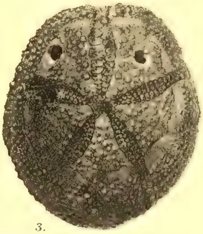
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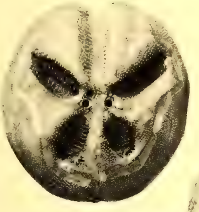
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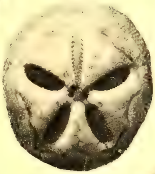
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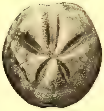
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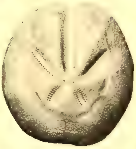
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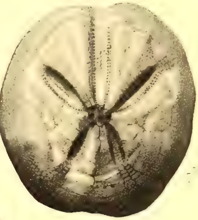
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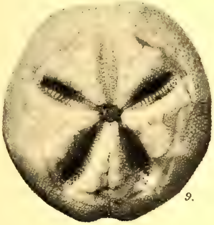
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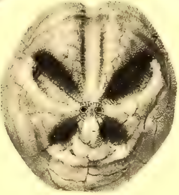
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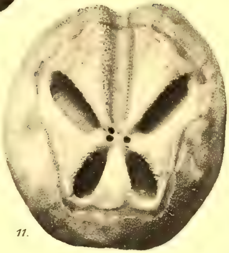
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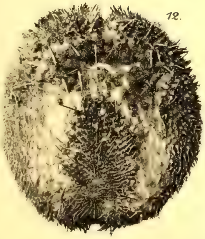
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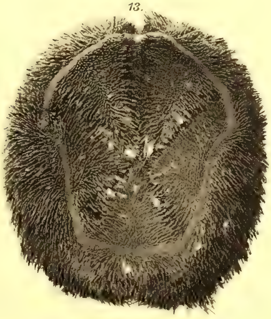
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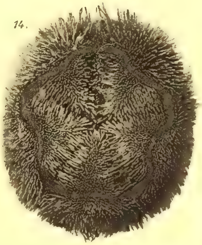
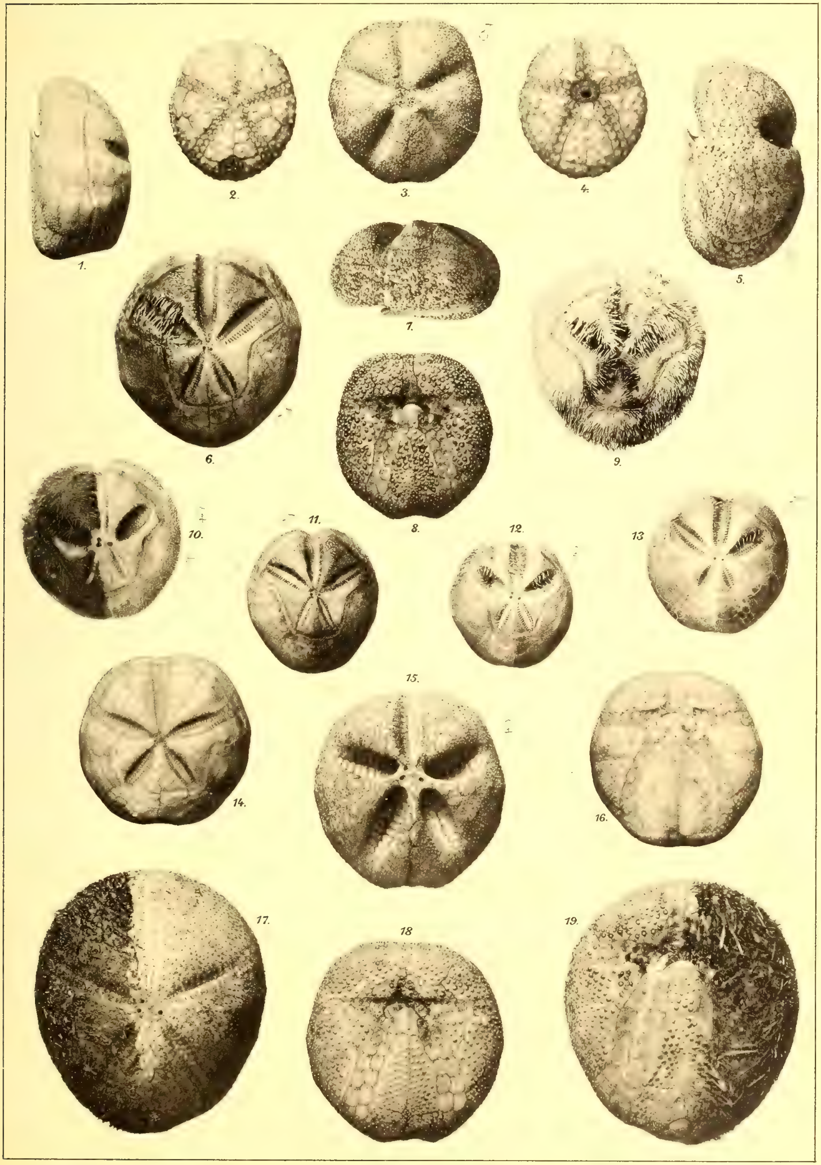

14.

Th. Bloch fot.

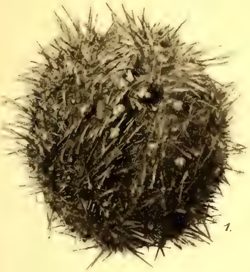
Ljustr. A.B. Lagrelius & Westphal. Stockh

1, 3, 5, 9, 14. *Abatus Agassizii (Pfeffer).* 2, 4, 6—8, 10—13. *A. cavernosus (Phil.).*



Th. Bloch fot.
Ljustr. A.B. Lagrelius & Westphal. Stockh.

2—5, 7, 8, 15, 18. *Amphipneustes Koehleri Mrtsn.* 17, 19. *Amphipn. Lorioli Koehler.*
1, 14, 16, *Tripylus excavatus Phil.* 6, 9—13. *Abatus Philippii Lovén.*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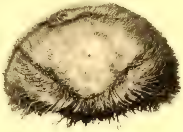
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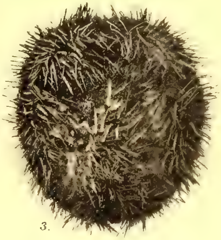
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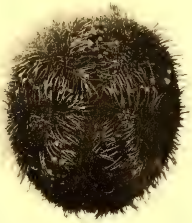
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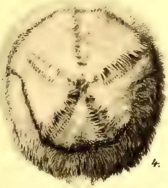
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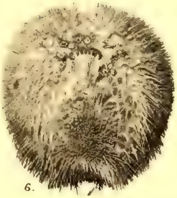
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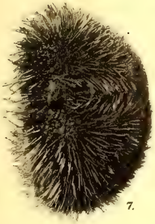
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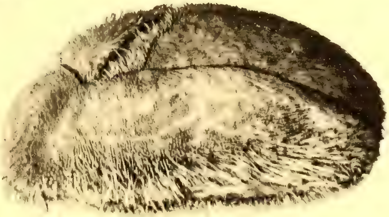
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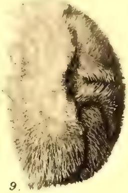
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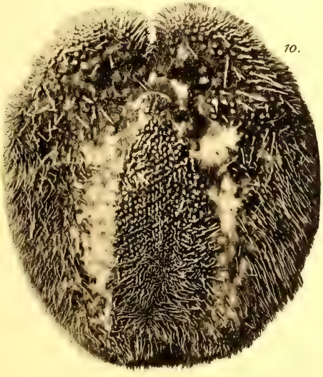
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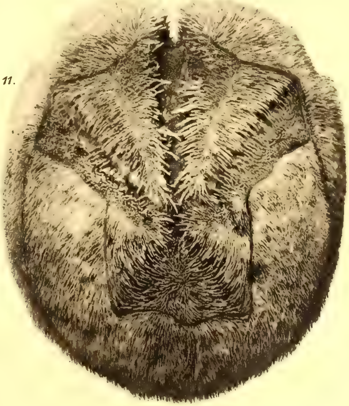
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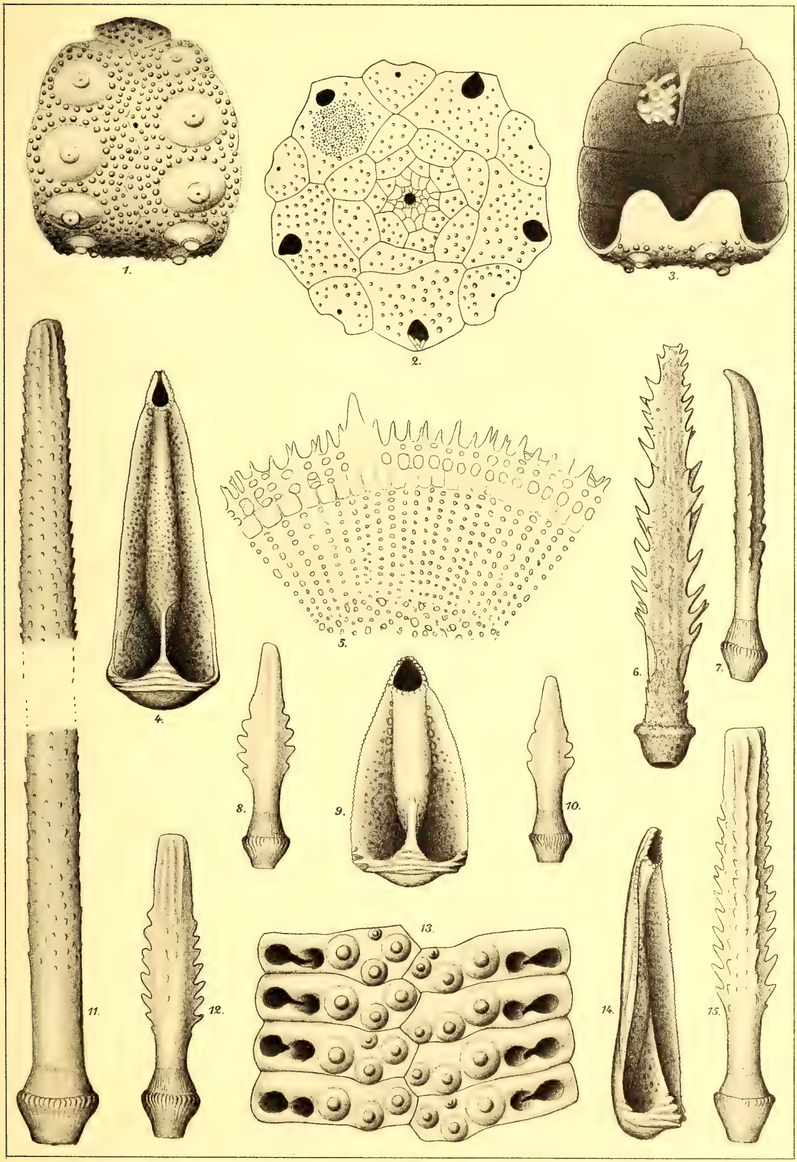
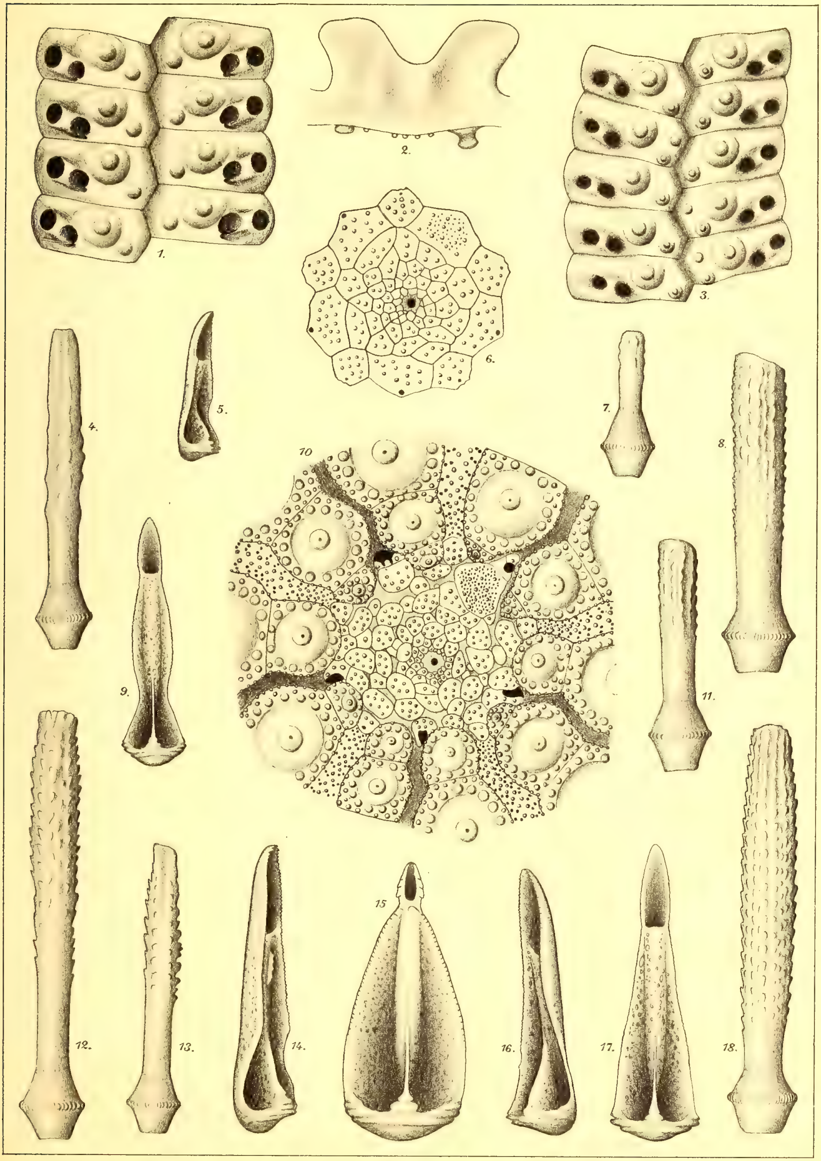
Th. Bloch fot. Ljustr. A.B. Lagrelius & Westphal. Stockh.

1, 3, 5, 7. *Amphipneustes Koehleri Mrtsn.* 2, 4, 6, 9. *Tripylus excavatus Phil.*
8, 10—11. *Schizaster (Tripylaster) Philippii (Gray).*



Th. Mortensen del.
Ljustr. A.B. Lagrelius & Westphal. Stockh

Ctenocidaris speciosa Mrtsn.



Th. Mortensen del.

Ljustr. A.B. Lagrelius & Westphal. Stockh.

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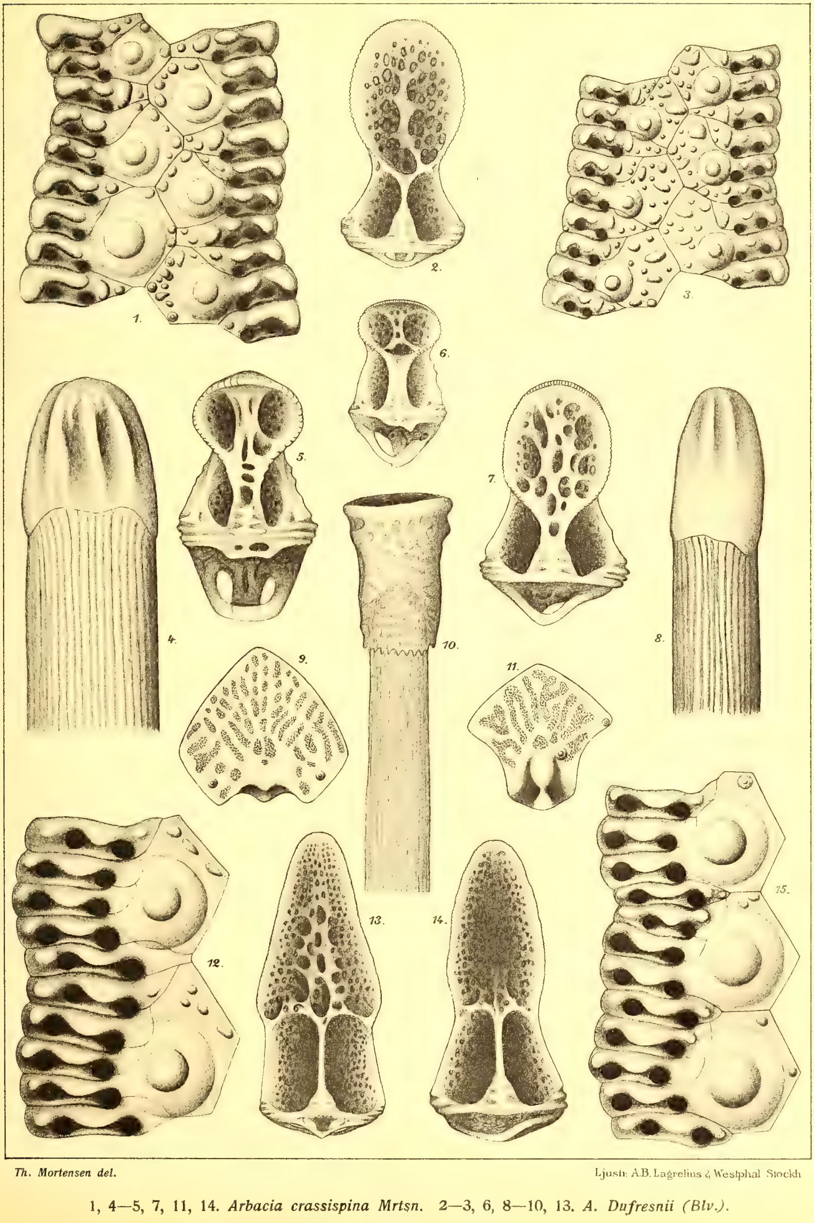
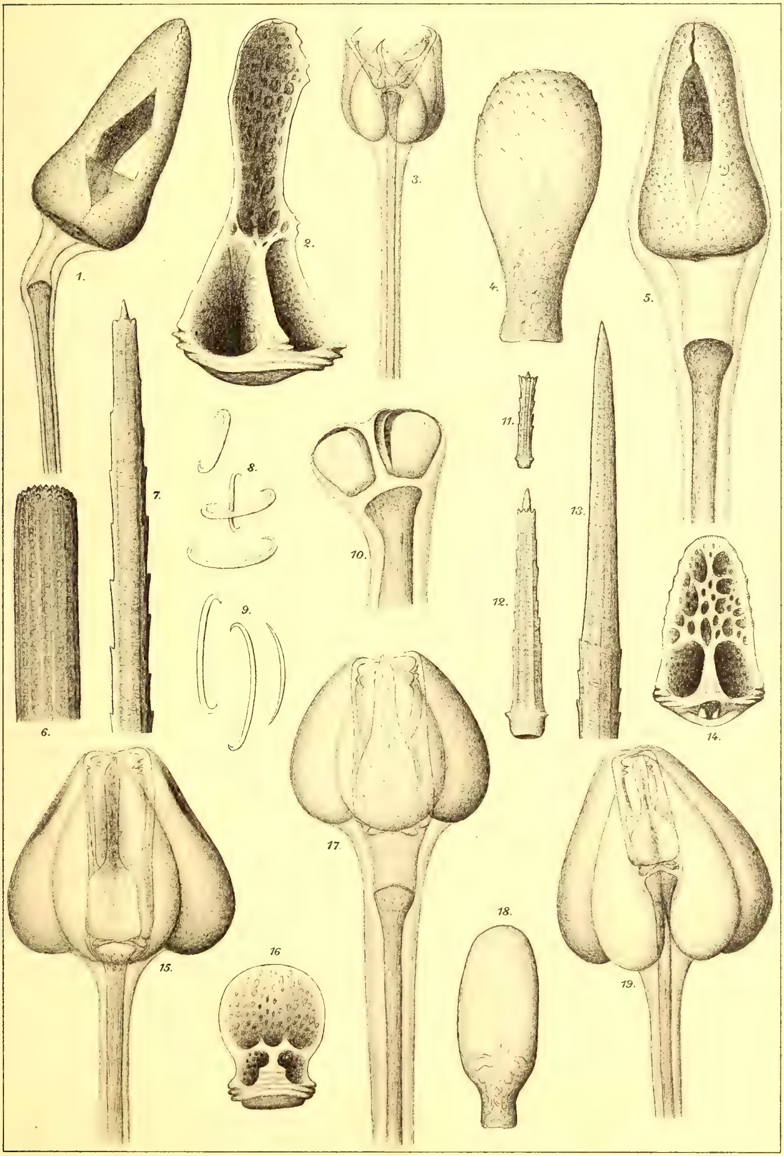


Th. Mortensen del.
Ljustr. A.B. Lagrelius & Westphal Stockh

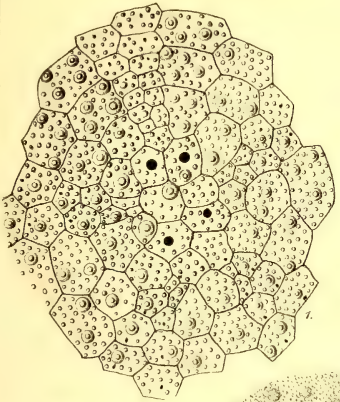
1, 4—5, 7, 11, 14. *Arbacia crassispina Mrtsn.* 2—3, 6, 8—10, 13. *A. Dufresnii (Blv.).*
12, 15. *Tetrapygus niger (Mol.).*



Th. Mortensen del.

Ljustr. A.B. Lagrelius & Westphal. Stockh.

1, 7—8, 13, 15, 16. *Sterechinus Agassizii Mrtsn.* 2, 4—5, 14, 16—17. *Loxechinus albus (Mol.).*
3, 6, 9—12, 19. *Notechinus magellanicus (Phil.).*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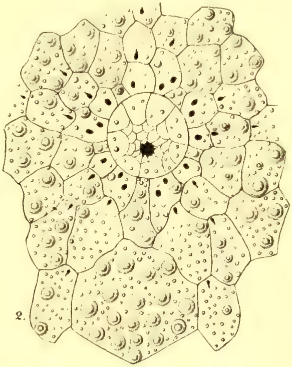
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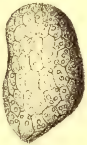
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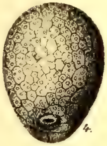
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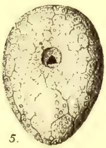
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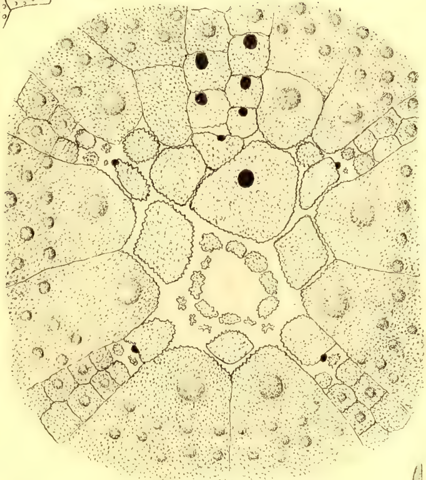
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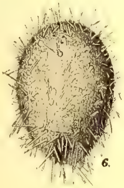
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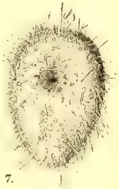
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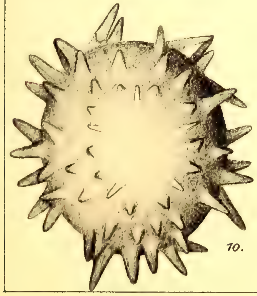
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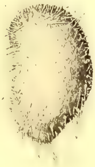
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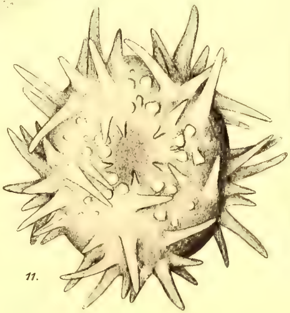
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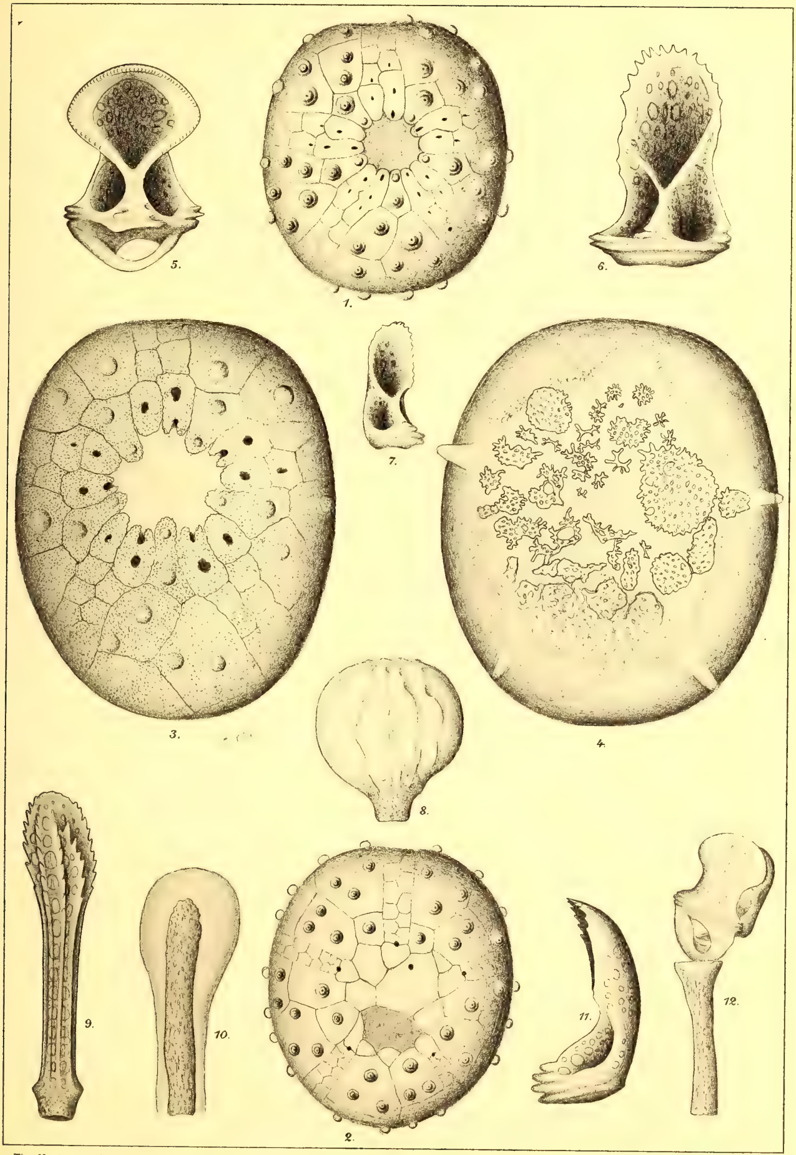
10—11. *Amphipneustes Koehleri Mrtsn.*



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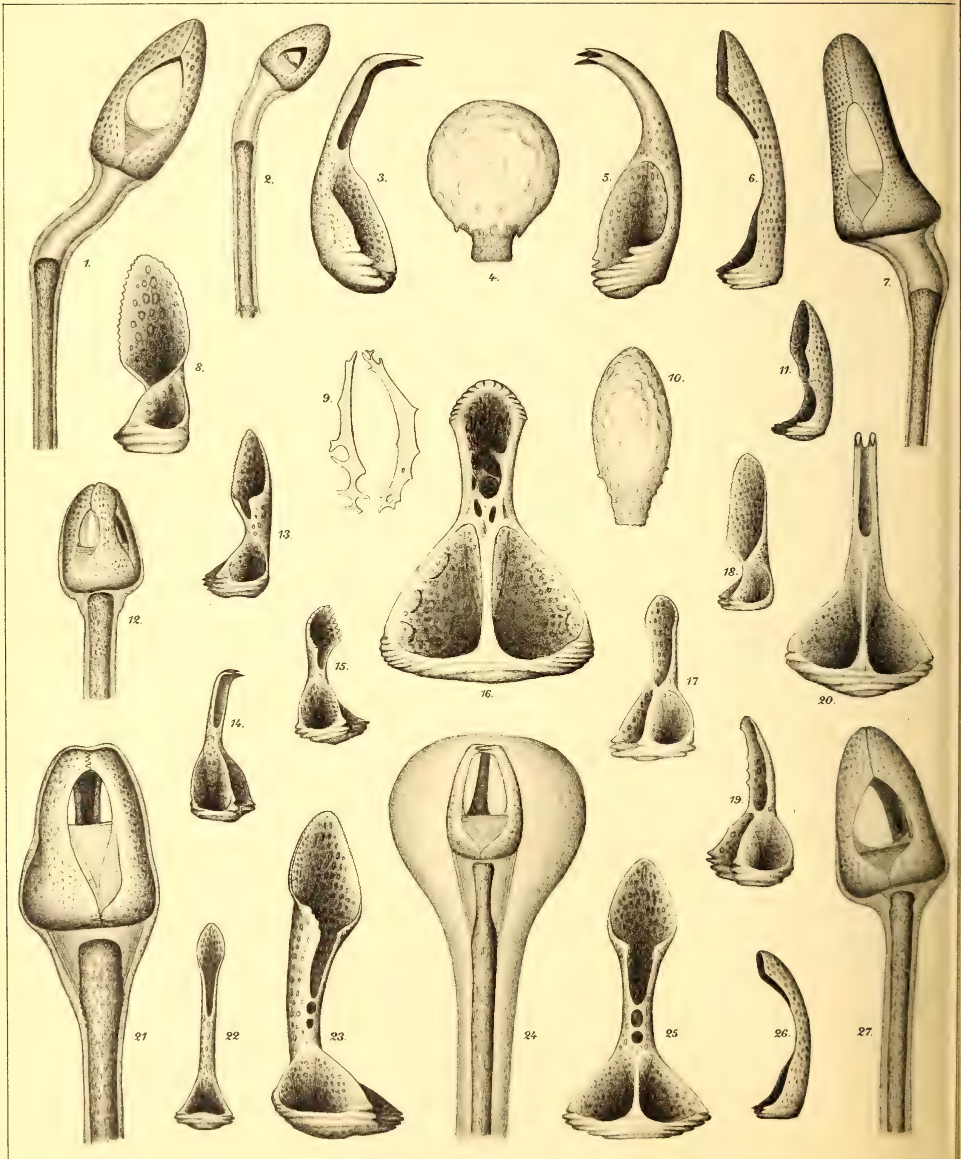

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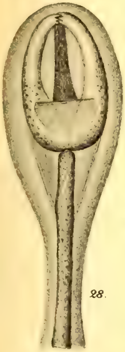
28—30, 32—33, 35—39, 41—43, 4
40. ***Abatus Agassizii* (*Pfef***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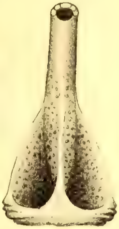
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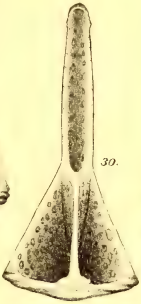
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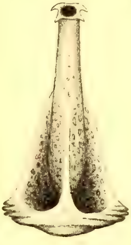
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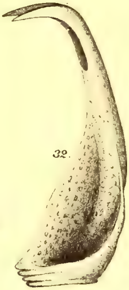
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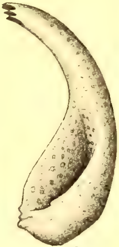
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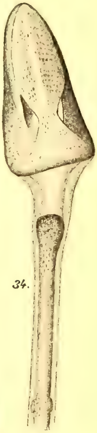
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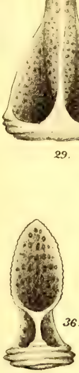
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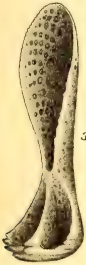
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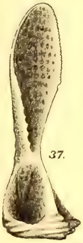
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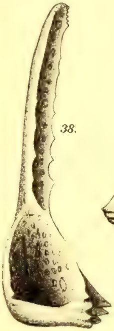
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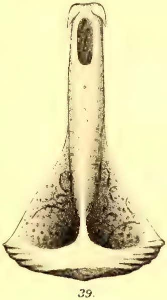
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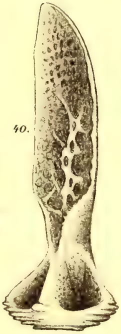
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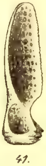
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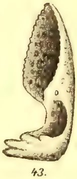
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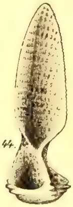
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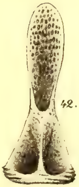
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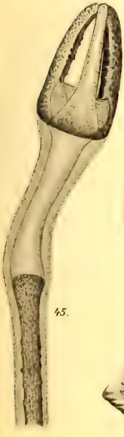
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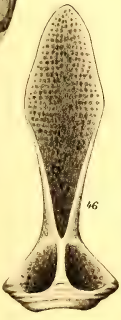
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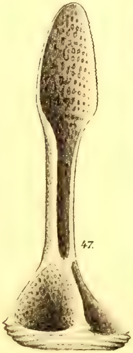
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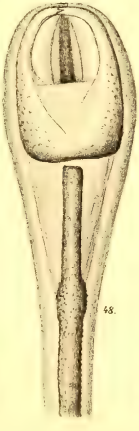
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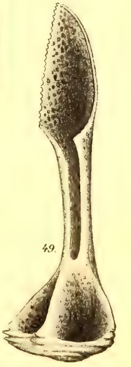
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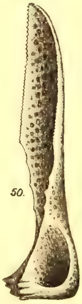
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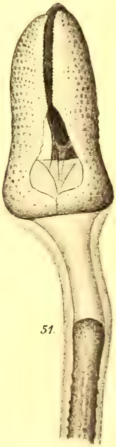
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–9, 13—14, 19—20, 23—25, 27. *Amphipneustes Koehleri Mrtsn.*
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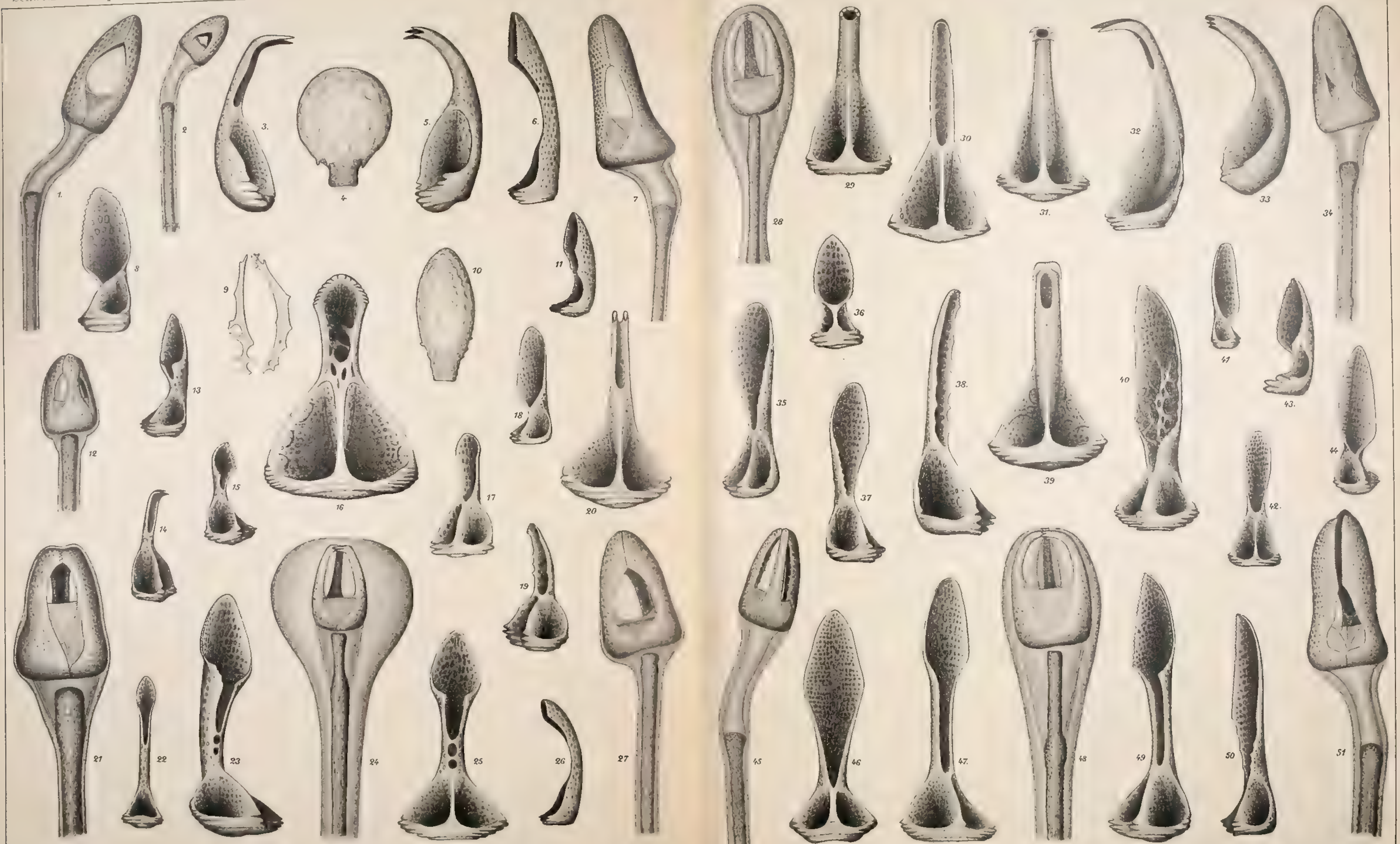
, 50—51. *Abatus cavernosus (Phil.)*
47. *Abatus Philippii Lovén.*



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5, 7, 15—16, 21, 31, 48—49. *Schizaster (Tripylaster) Philippii (Gray).* 18, 34, 44. *Tripylus excavatus Phil.*
28—30, 32—33, 35—39, 41—43, 45—46, 50—51. *Abatus cavernosus (Phil.)*
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